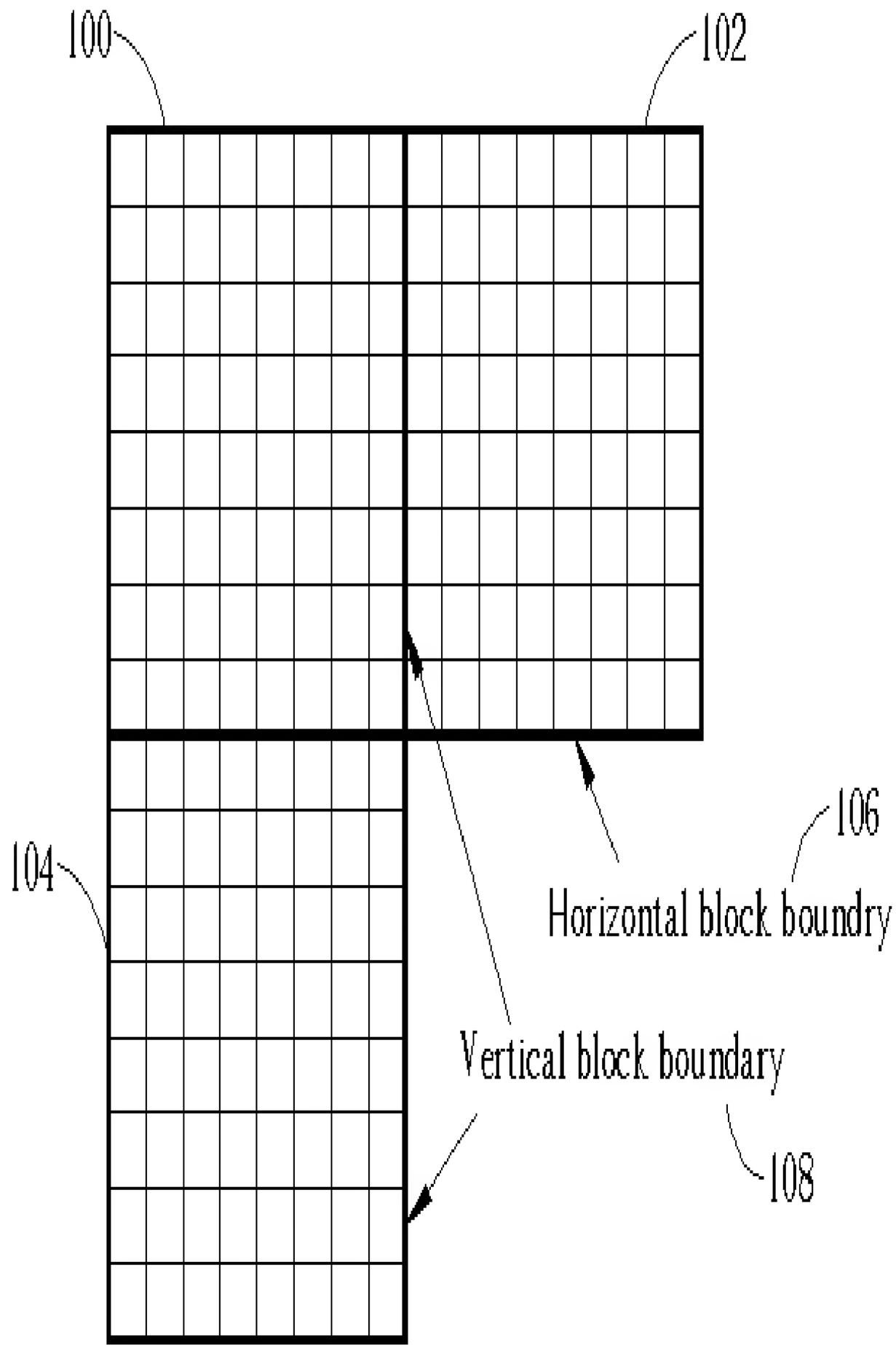


Fig. 1 Prior art

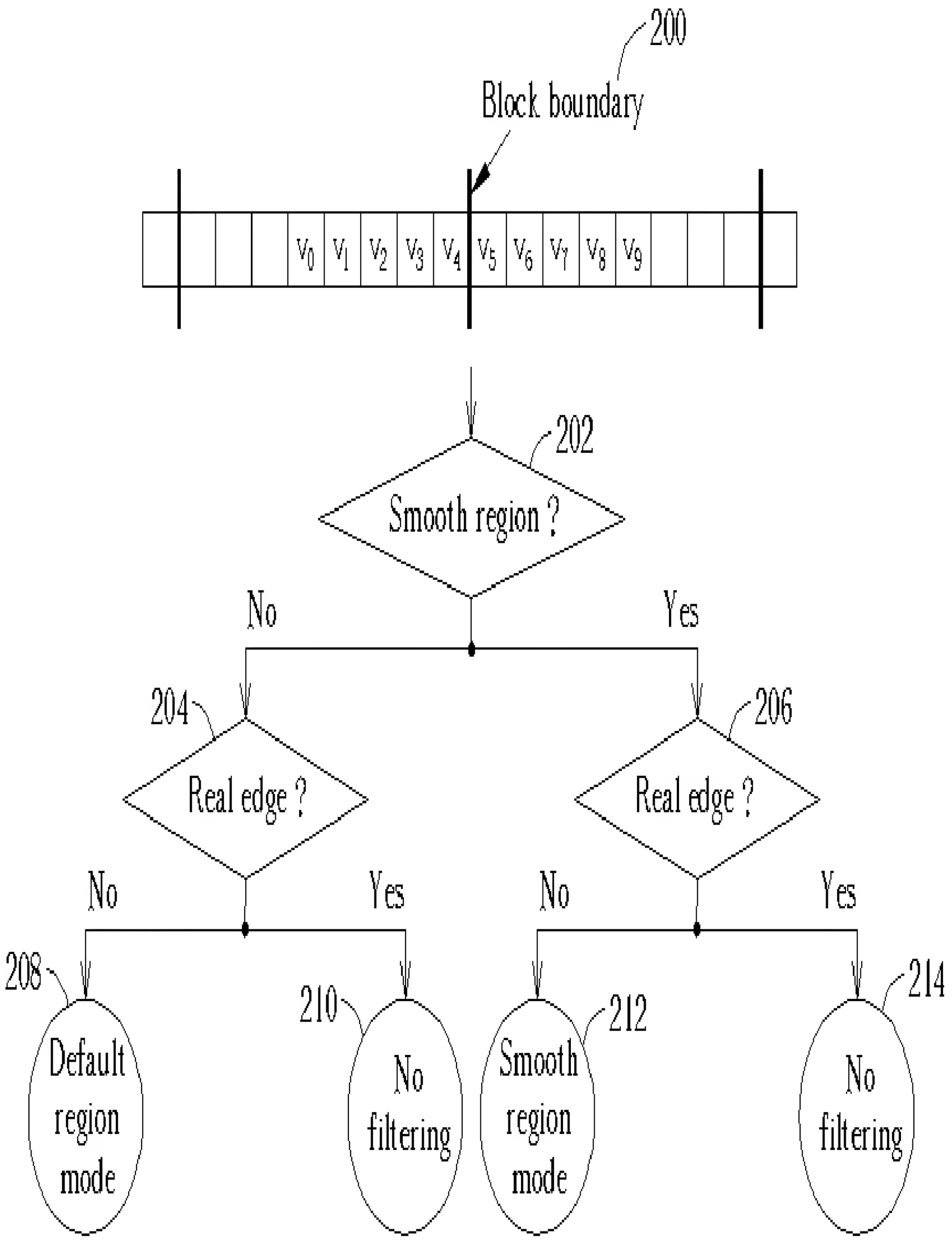


Fig. 2 Prior art

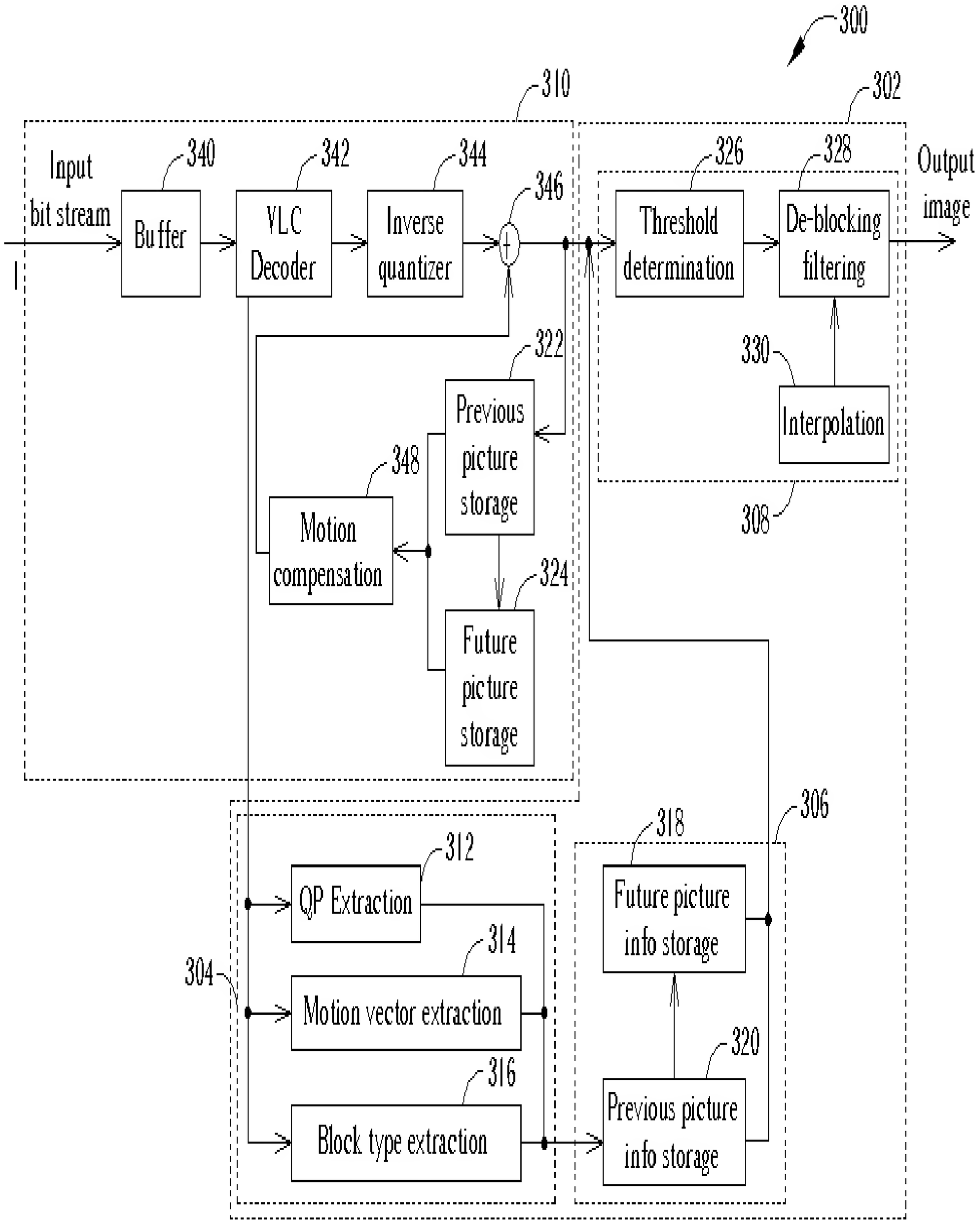

300
310
302
Input bit stream
340
Buffer
342
VLC Decoder
344
Inverse quantizer
346
326
Threshold determination
328
De-blocking filtering
Output image
330
Interpolation
308
322
Previous picture storage
348
Motion compensation
324
Future picture storage
306
318
Future picture info storage
312
QP Extraction
314
Motion vector extraction
316
Block type extraction
320
Previous picture info storage
304

Fig. 3

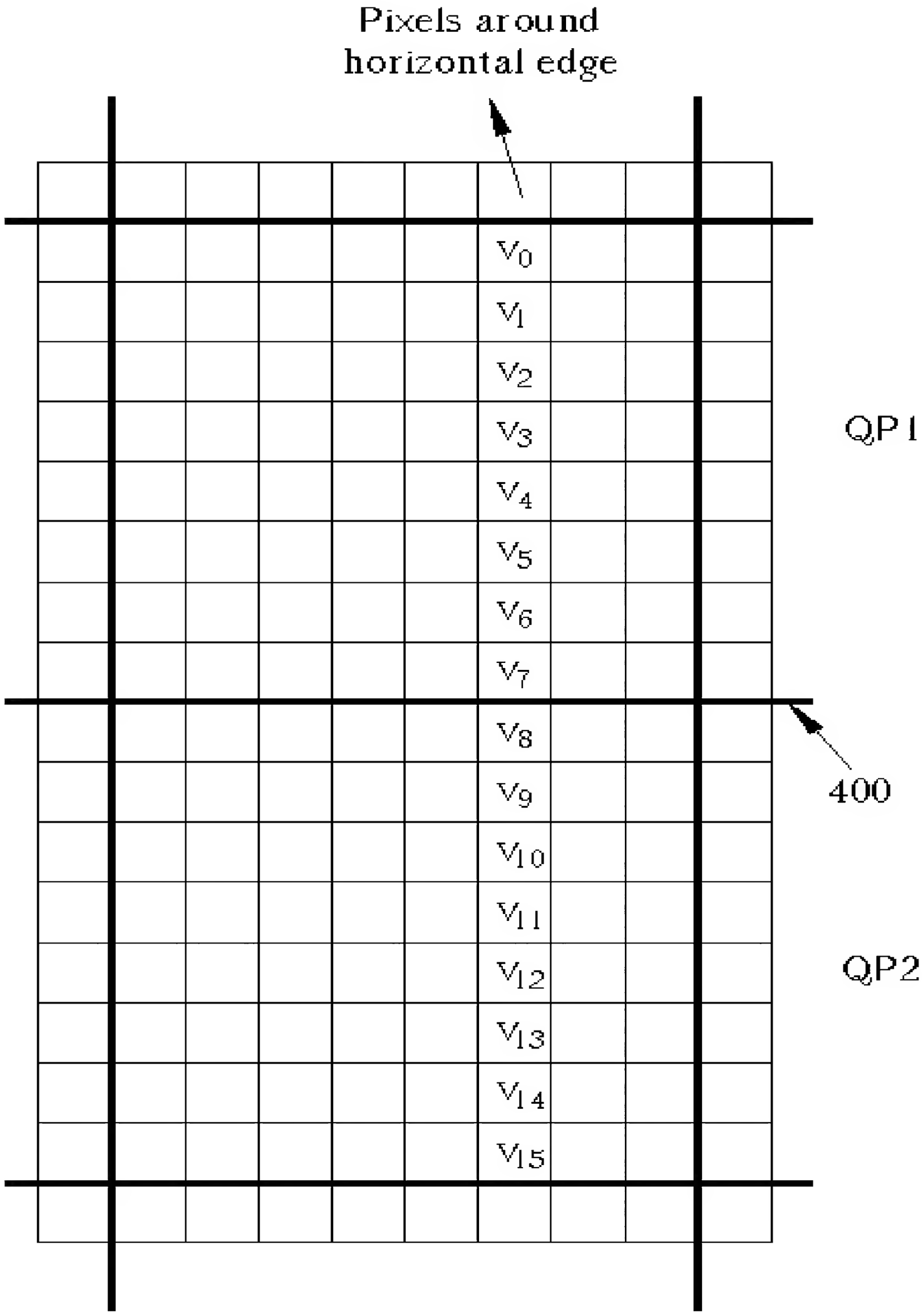

Pixels around
horizontal edge
V0
V1
V2
V3
V4
V5
V6
V7
V8
V9
V10
V11
V12
V13
V14
V15
QP1
QP2
400

Fig. 4

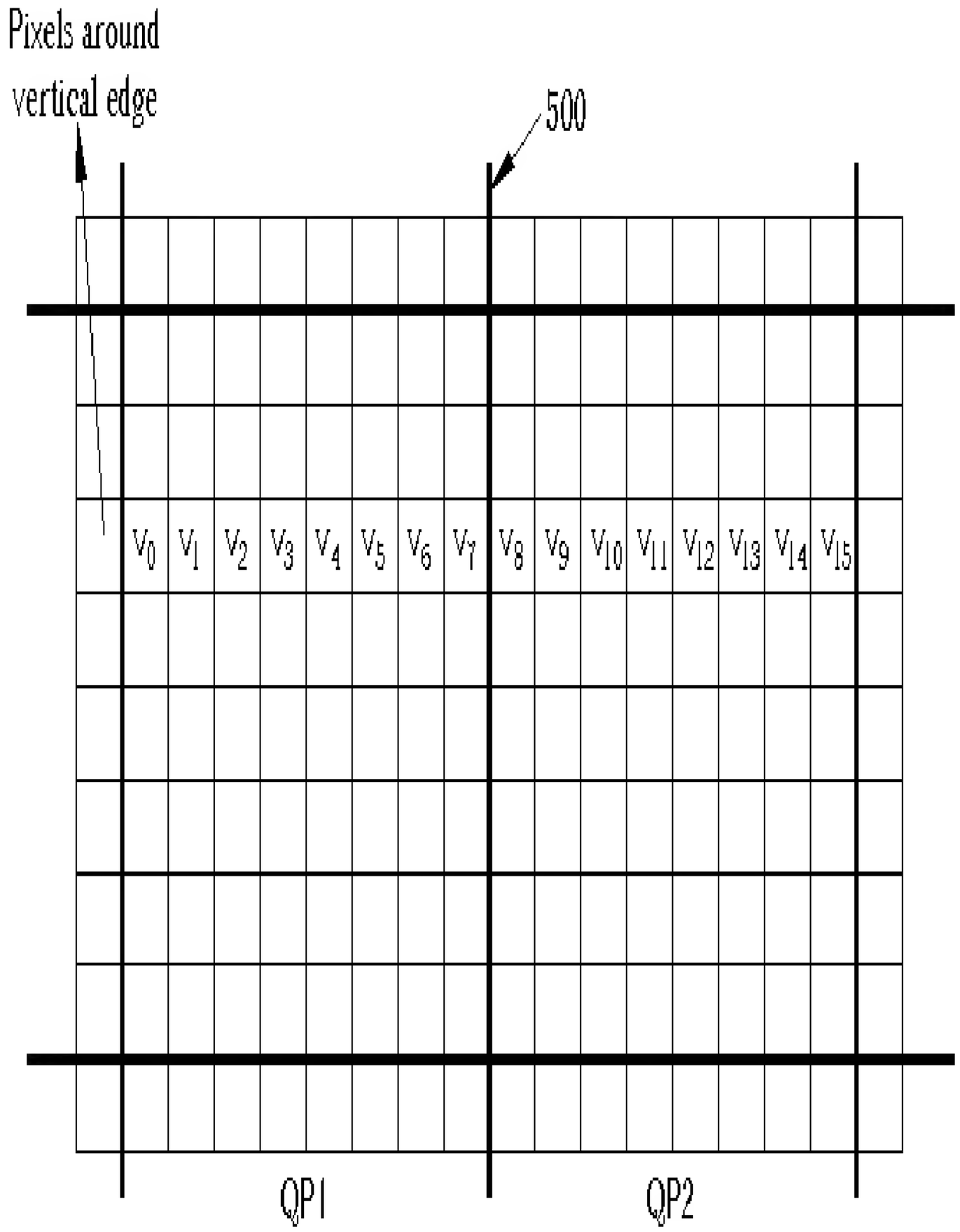

Pixels around
vertical edge
500
V0
V1
V2
V3
V4
V5
V6
V7
V8
V9
V10
V11
V12
V13
V14
V15
QP1
QP2

Fig. 5

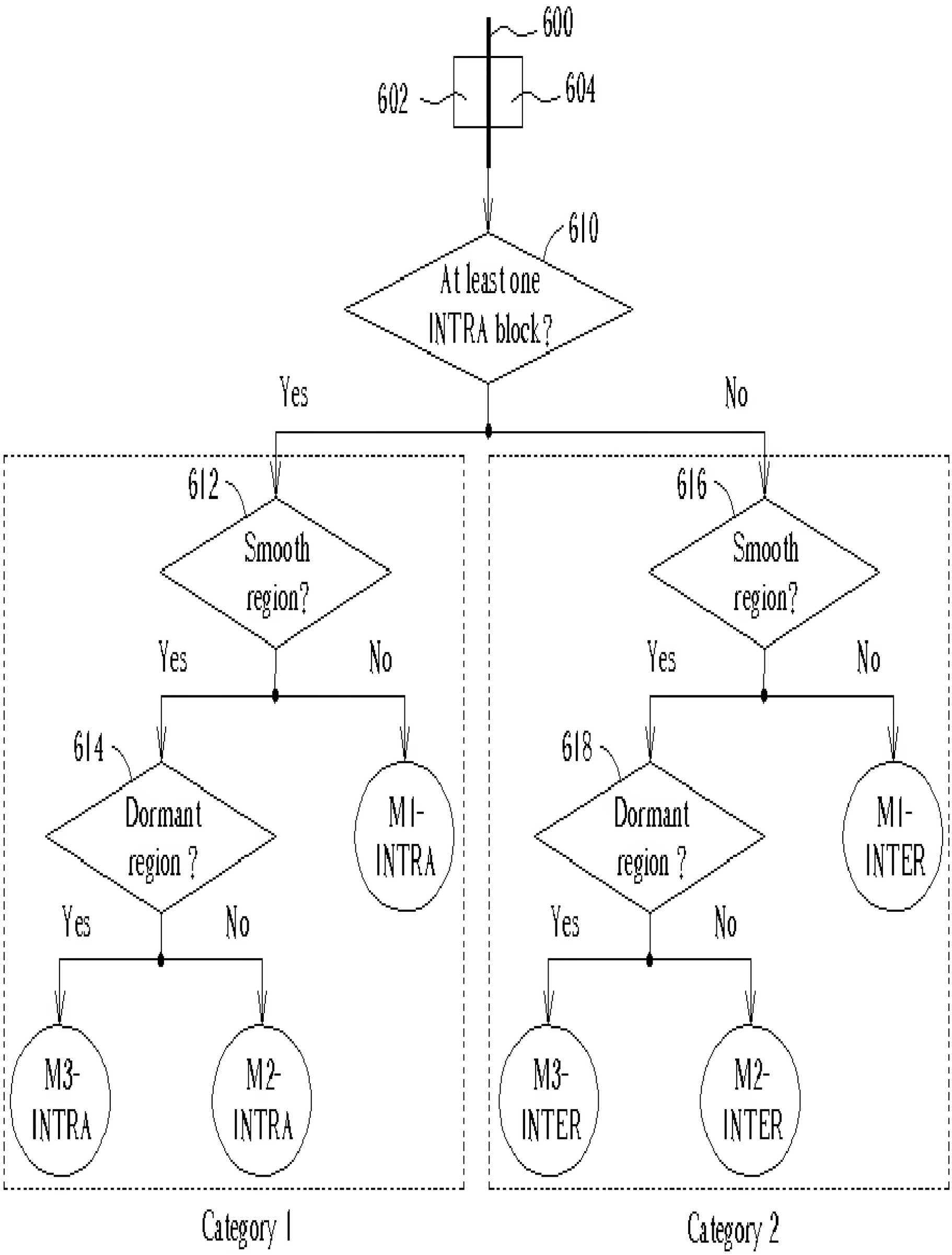

600
602
604
610
At least one INTRA block?
Yes
No
612
Smooth region?
Yes
No
614
Dormant region ?
Yes
No
M1-INTRA
M3-INTRA
M2-INTRA
Category 1
616
Smooth region?
Yes
No
618
Dormant region ?
Yes
No
M1-INTER
M3-INTER
M2-INTER
Category 2

Fig. 6

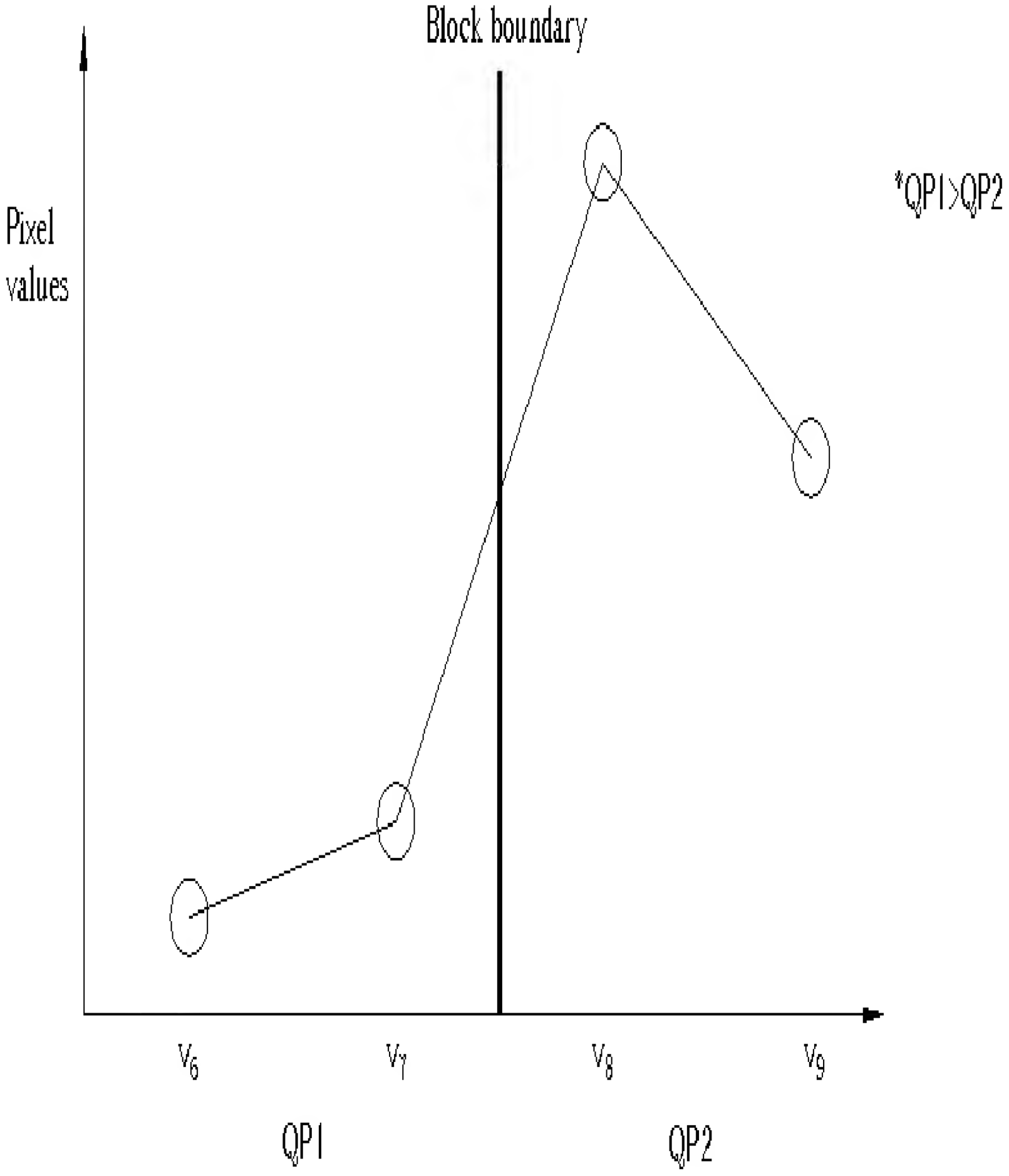


Fig. 7

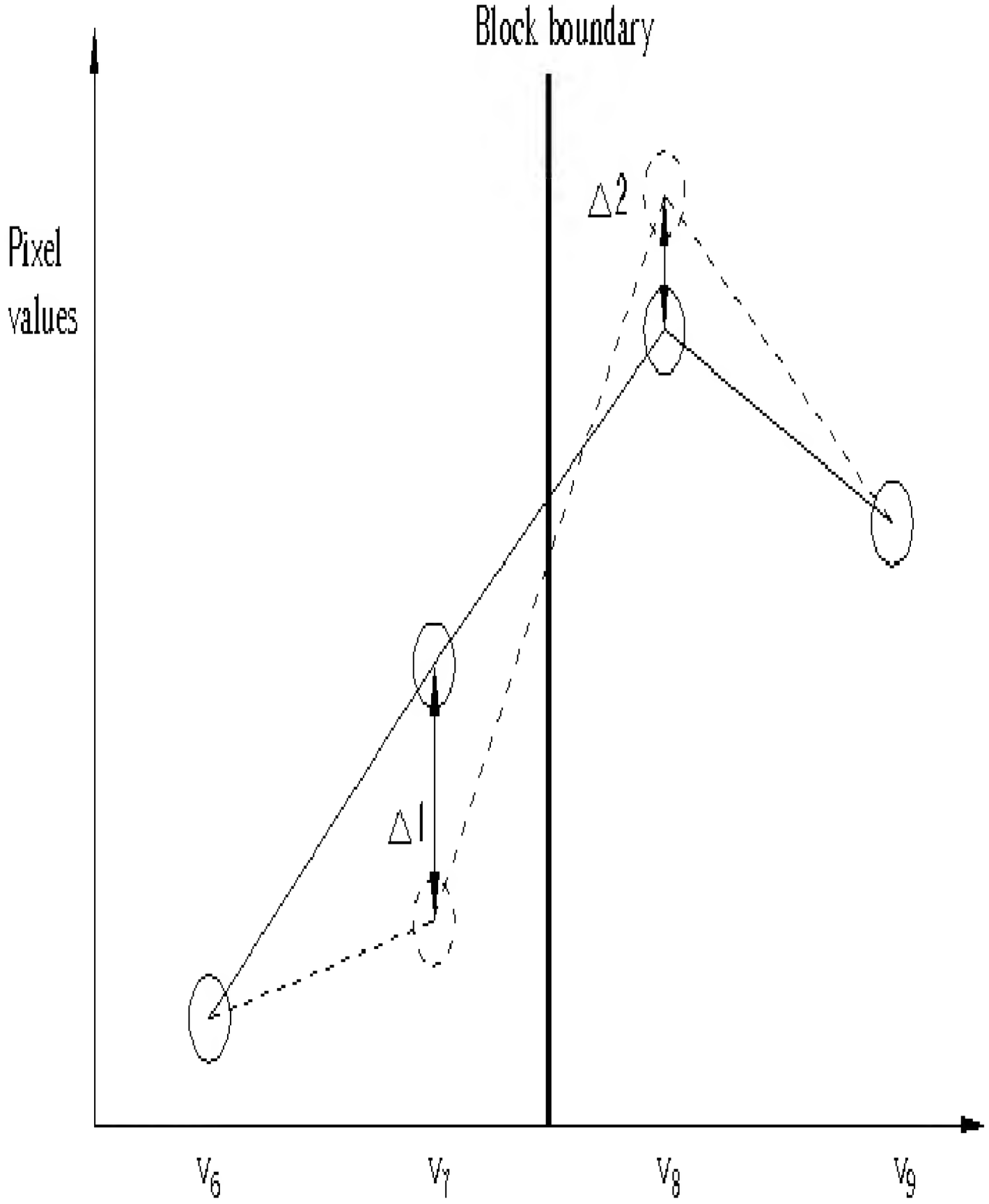


Fig. 8

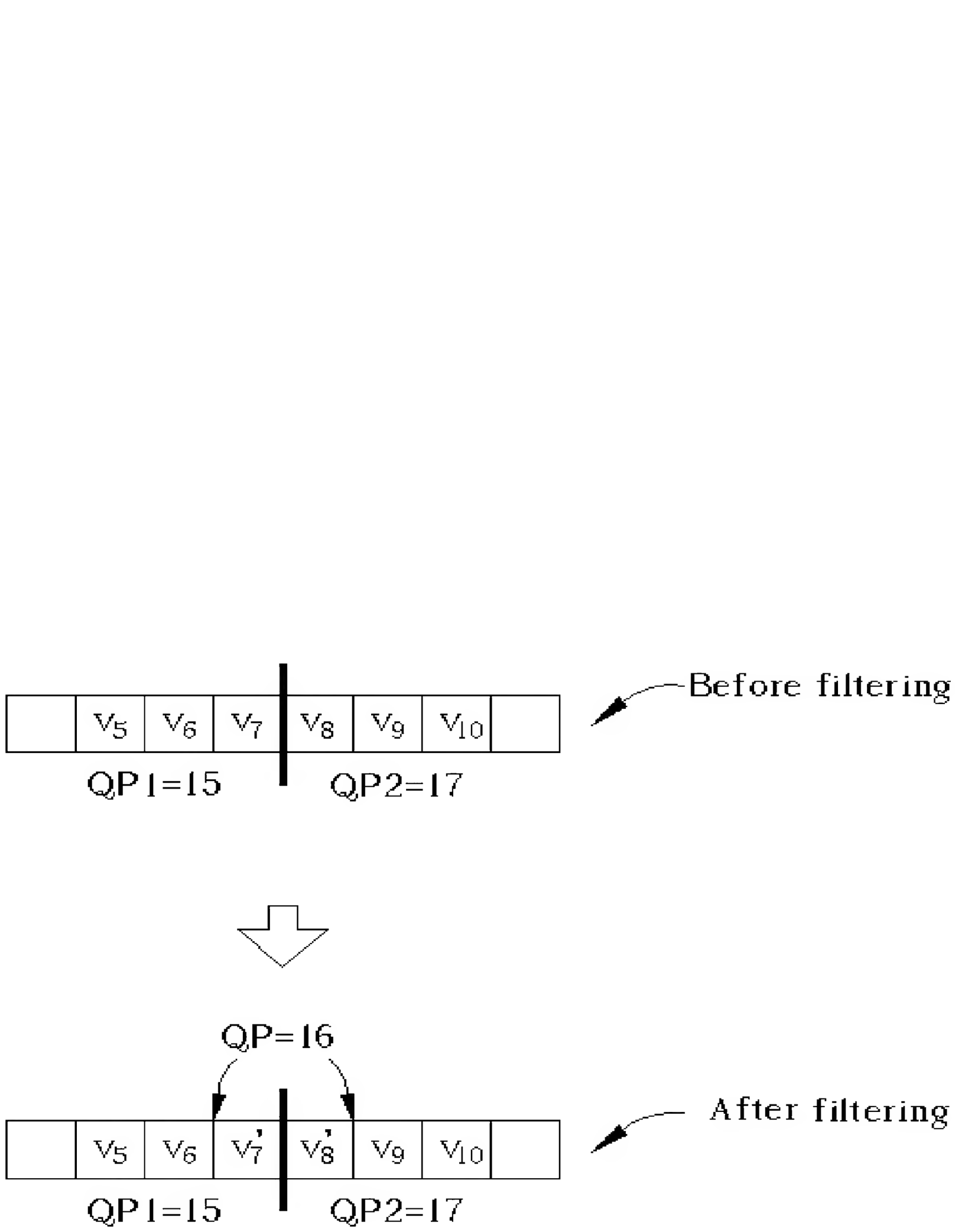

Before filtering
V5
V6
V7
V8
V9
V10
QP1=15
QP2=17
QP=16
V7'
V8'
After filtering
QP1=15
QP2=17

Fig. 9

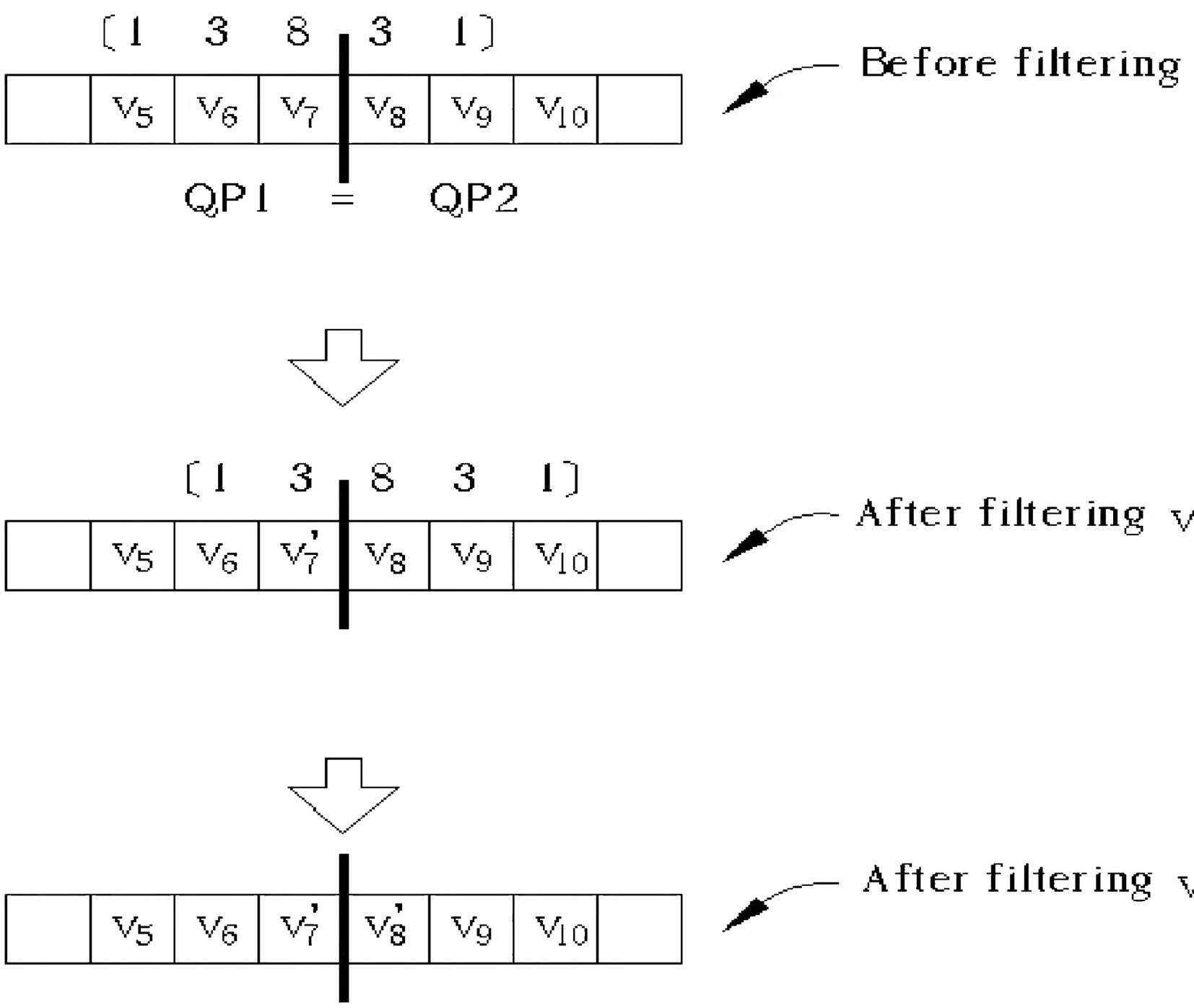

[1 3 8 3 1]
V5 V6 V7 V8 V9 V10
QP1 = QP2
Before filtering
[1 3 8 3 1]
V5 V6 V7' V8 V9 V10
After filtering V7
V5 V6 V7' V8' V9 V10
After filtering V8

Fig. 10

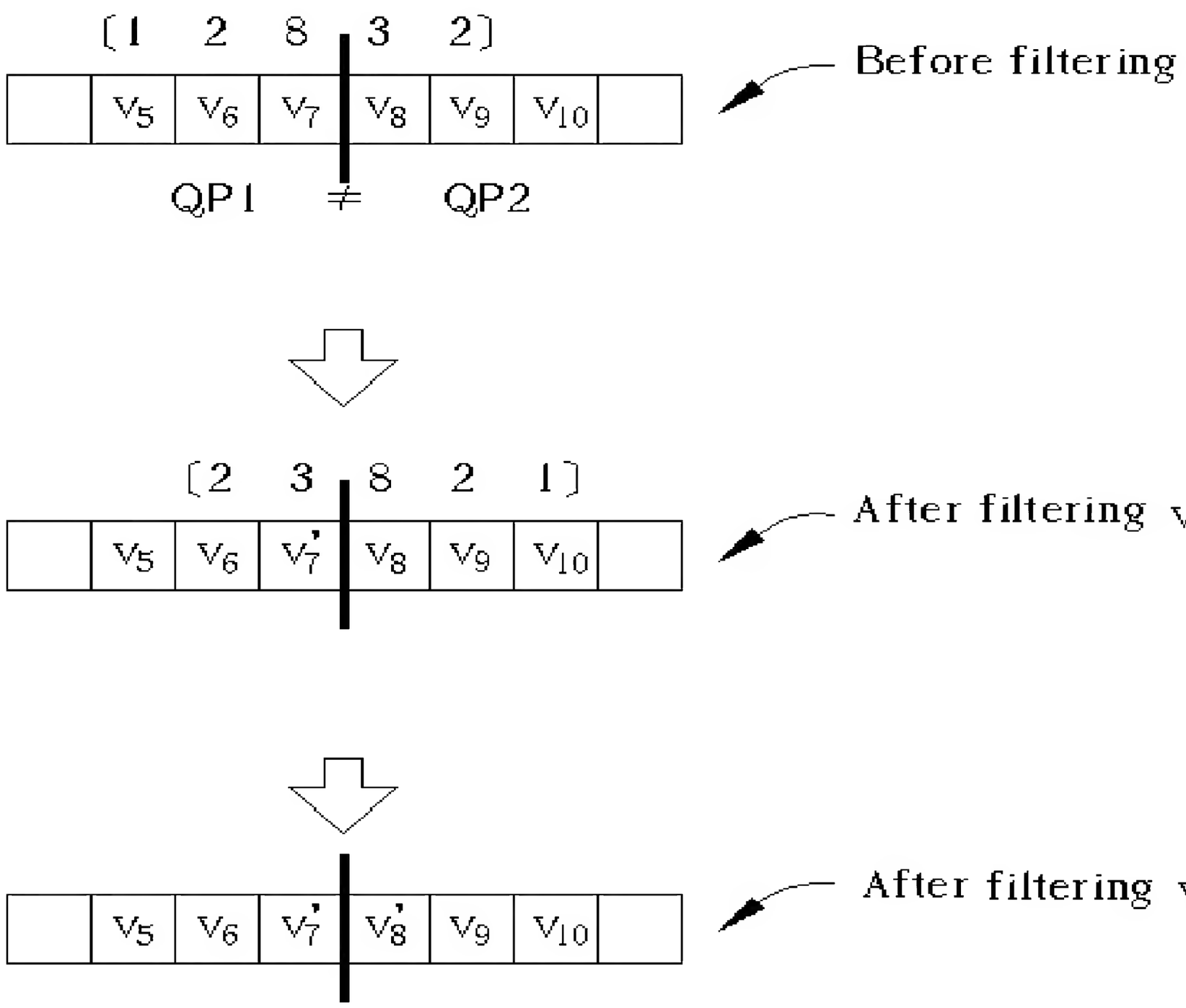

[1 2 8 3 2]
V5 V6 V7 V8 V9 V10
Before filtering
QP1 ≠ QP2
[2 3 8 2 1]
V5 V6 V7' V8 V9 V10
After filtering V7
V5 V6 V7' V8' V9 V10
After filtering V8

Fig. 11

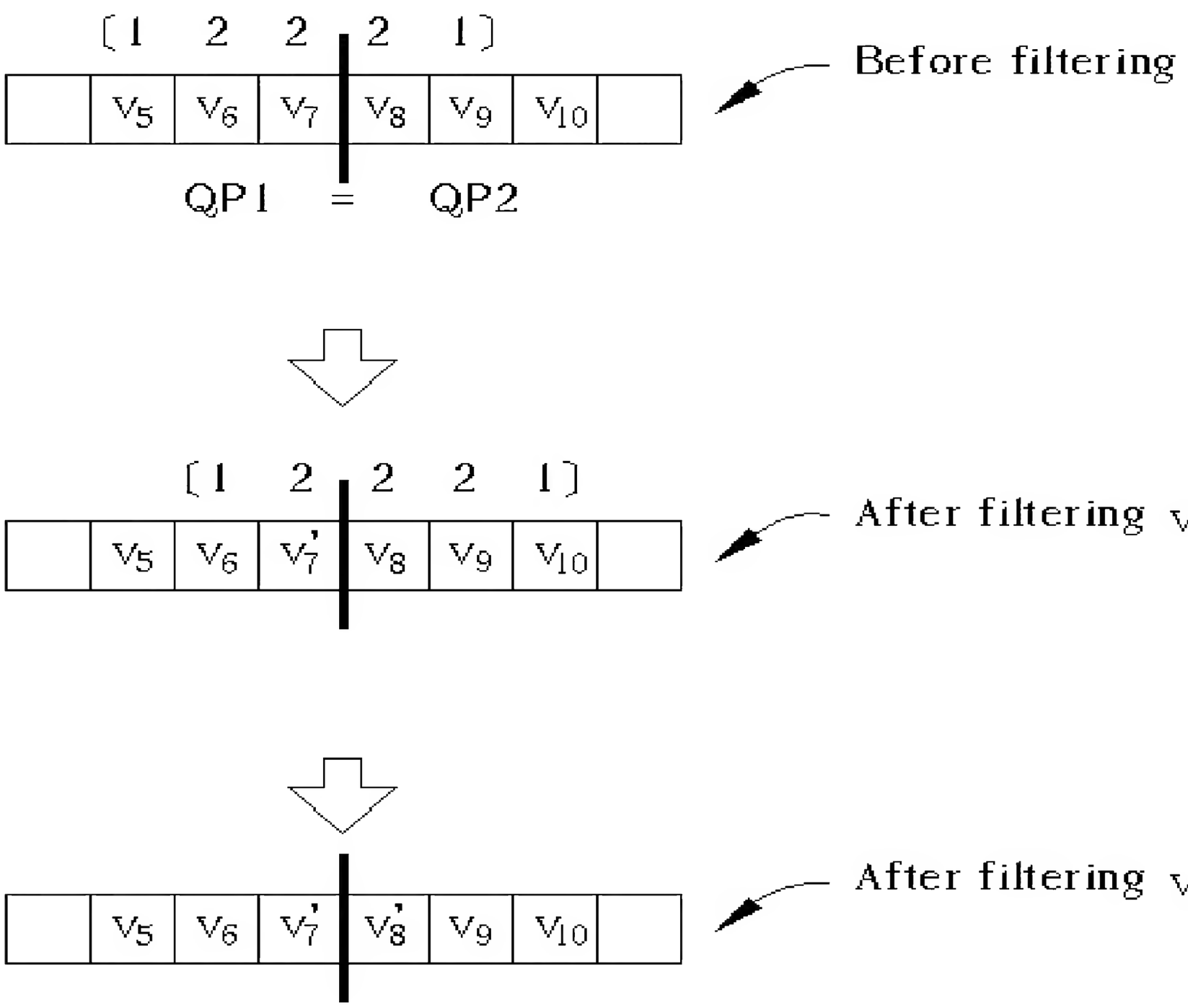

[1 2 2 2 1]
V5
V6
V7
V8
V9
V10
QP1 = QP2
Before filtering
[1 2 2 2 1]
V5
V6
V7'
V8
V9
V10
After filtering V7
V5
V6
V7'
V8'
V9
V10
After filtering V8

Fig. 12

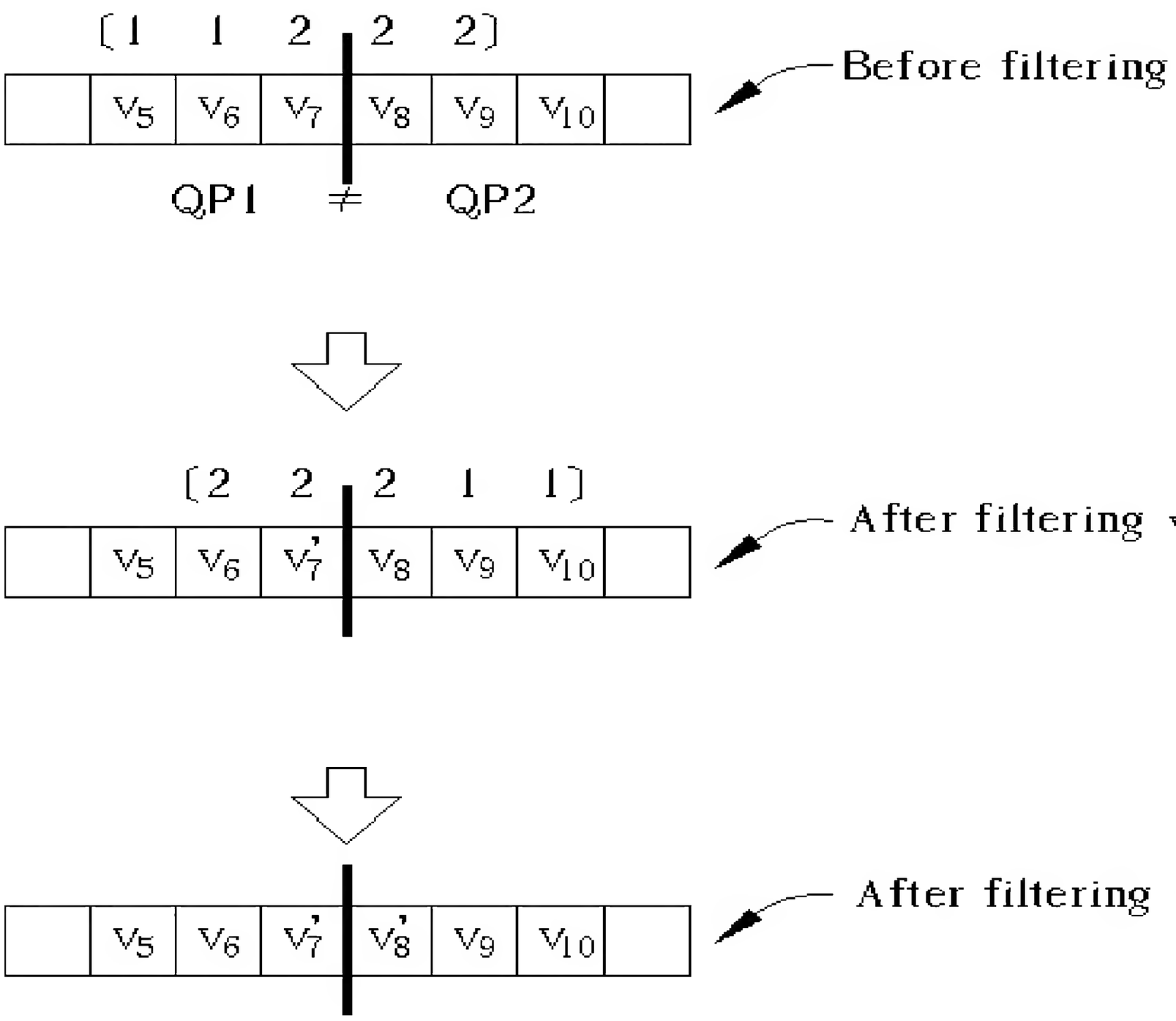
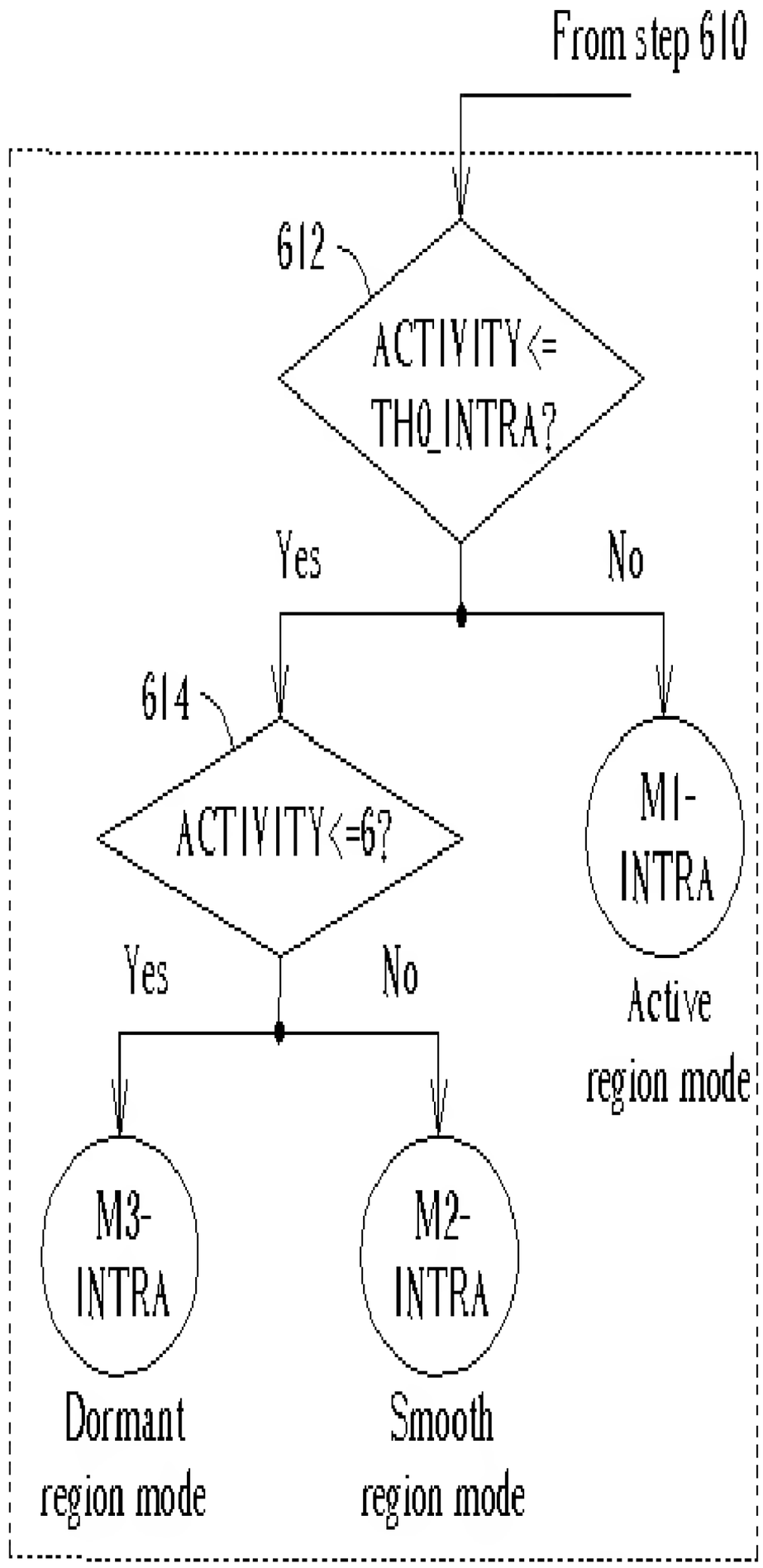

[1 1 2 2 2]
V5 V6 V7 V8 V9 V10
Before filtering
QP1 ≠ QP2
[2 2 2 1 1]
V5 V6 V7' V8 V9 V10
After filtering V7
V5 V6 V7' V8' V9 V10
After filtering V8

Fig. 13



Category I

Fig. 14

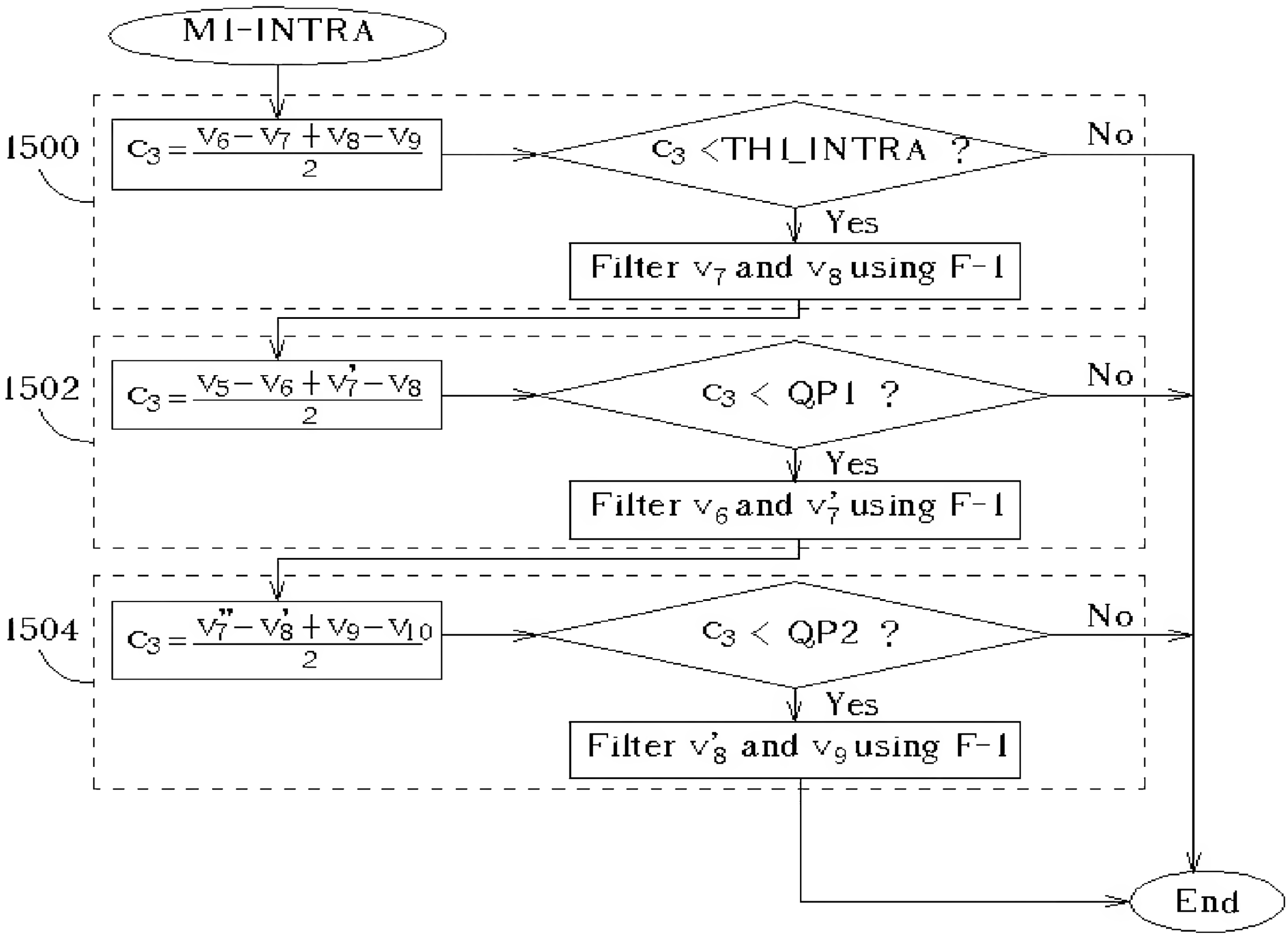

MI-INTRA
1500
$C_3 = \frac{V_6 - V_7 + V_8 - V_9}{2}$
C_3 <THI_INTRA ?
No
Yes
Filter V_7 and V_8 using F-1
1502
$C_3 = \frac{V_5 - V_6 + V_7' - V_8}{2}$
C_3 < QP1 ?
No
Yes
Filter V_6 and V_7' using F-1
1504
$C_3 = \frac{V_7'' - V_8' + V_9 - V_{10}}{2}$
C_3 < QP2 ?
No
Yes
Filter V_8' and V_9 using F-1
End

Fig. 15

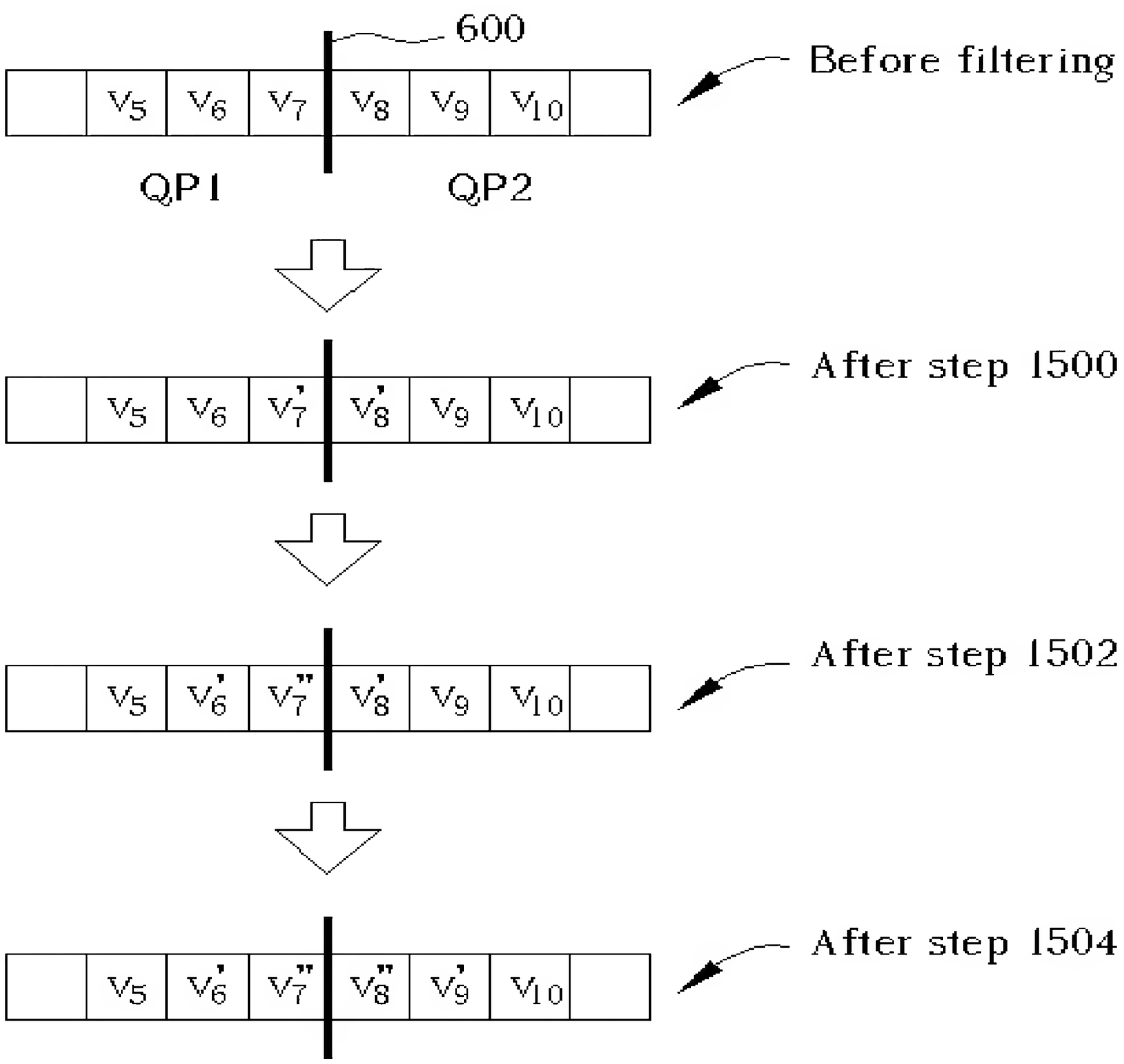

600
Before filtering
V5
V6
V7
V8
V9
V10
QP1
QP2
After step 1500
V5
V6
V7'
V8'
V9
V10
After step 1502
V5
V6'
V7"
V8'
V9
V10
After step 1504
V5
V6'
V7"
V8"
V9'
V10

Fig. 16

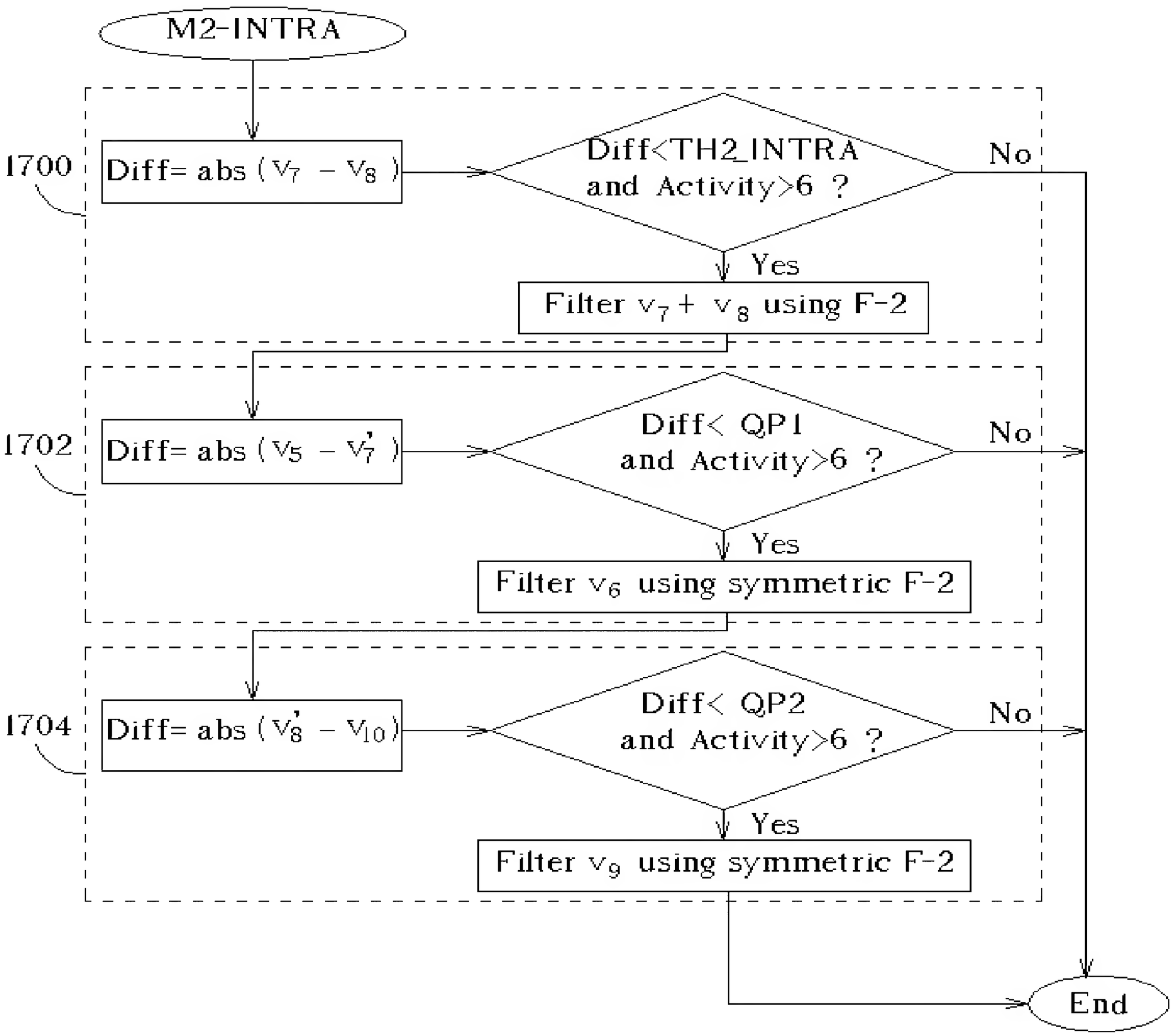

M2-INTRA
1700
Diff= abs (V7 – V8)
Diff<TH2_INTRA and Activity>6 ?
No
Yes
Filter v7 + v8 using F-2
1702
Diff= abs (V5 – V7')
Diff< QP1 and Activity>6 ?
No
Yes
Filter v6 using symmetric F-2
1704
Diff= abs (V8' – V10)
Diff< QP2 and Activity>6 ?
No
Yes
Filter v9 using symmetric F-2
End

Fig. 17

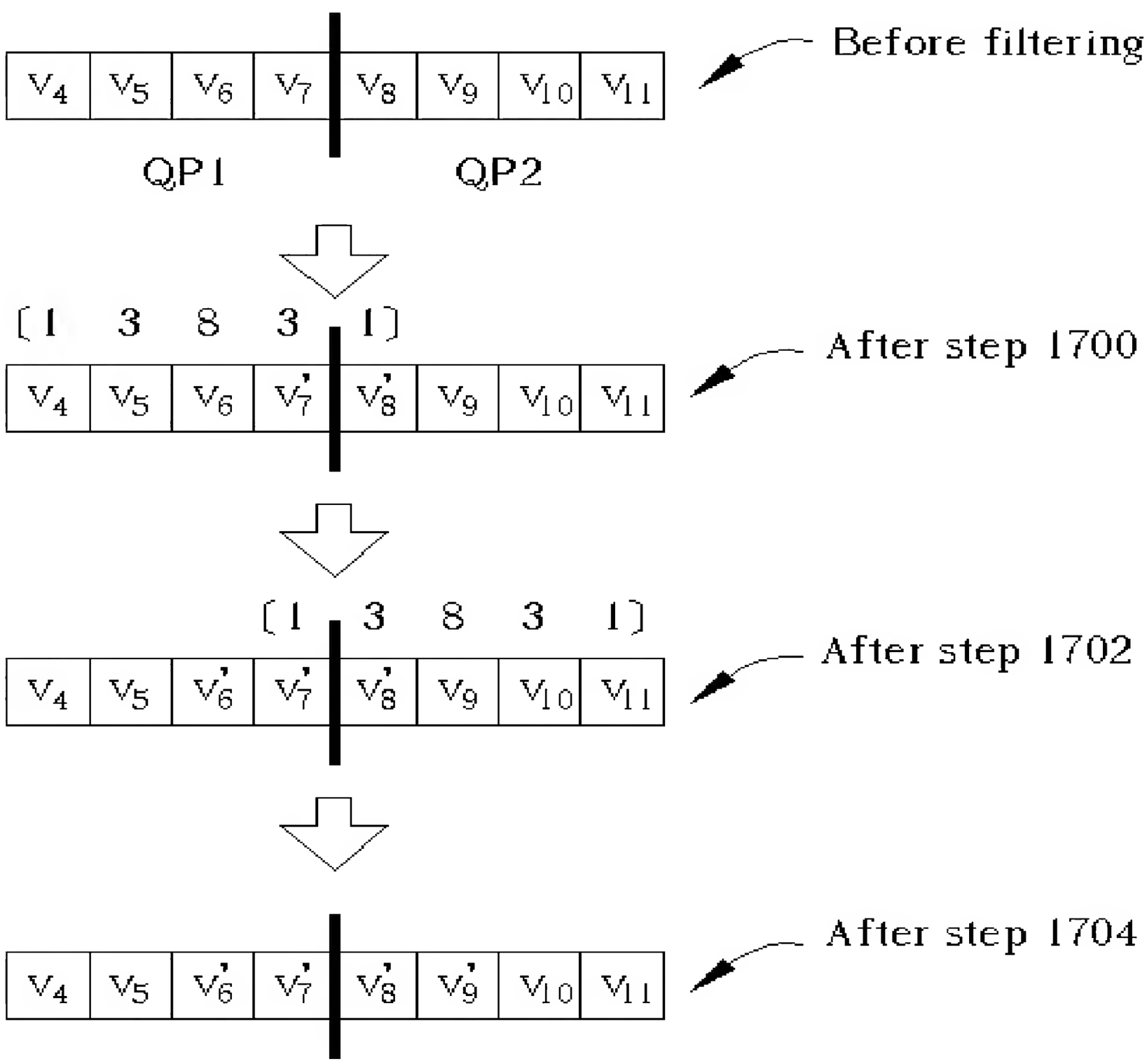

Before filtering
V4 V5 V6 V7 V8 V9 V10 V11
QP1
QP2
[1 3 8 3 1]
After step 1700
V4 V5 V6 V7' V8' V9 V10 V11
[1 3 8 3 1]
After step 1702
V4 V5 V6' V7' V8' V9 V10 V11
After step 1704
V4 V5 V6' V7' V8' V9' V10 V11

Fig. 18

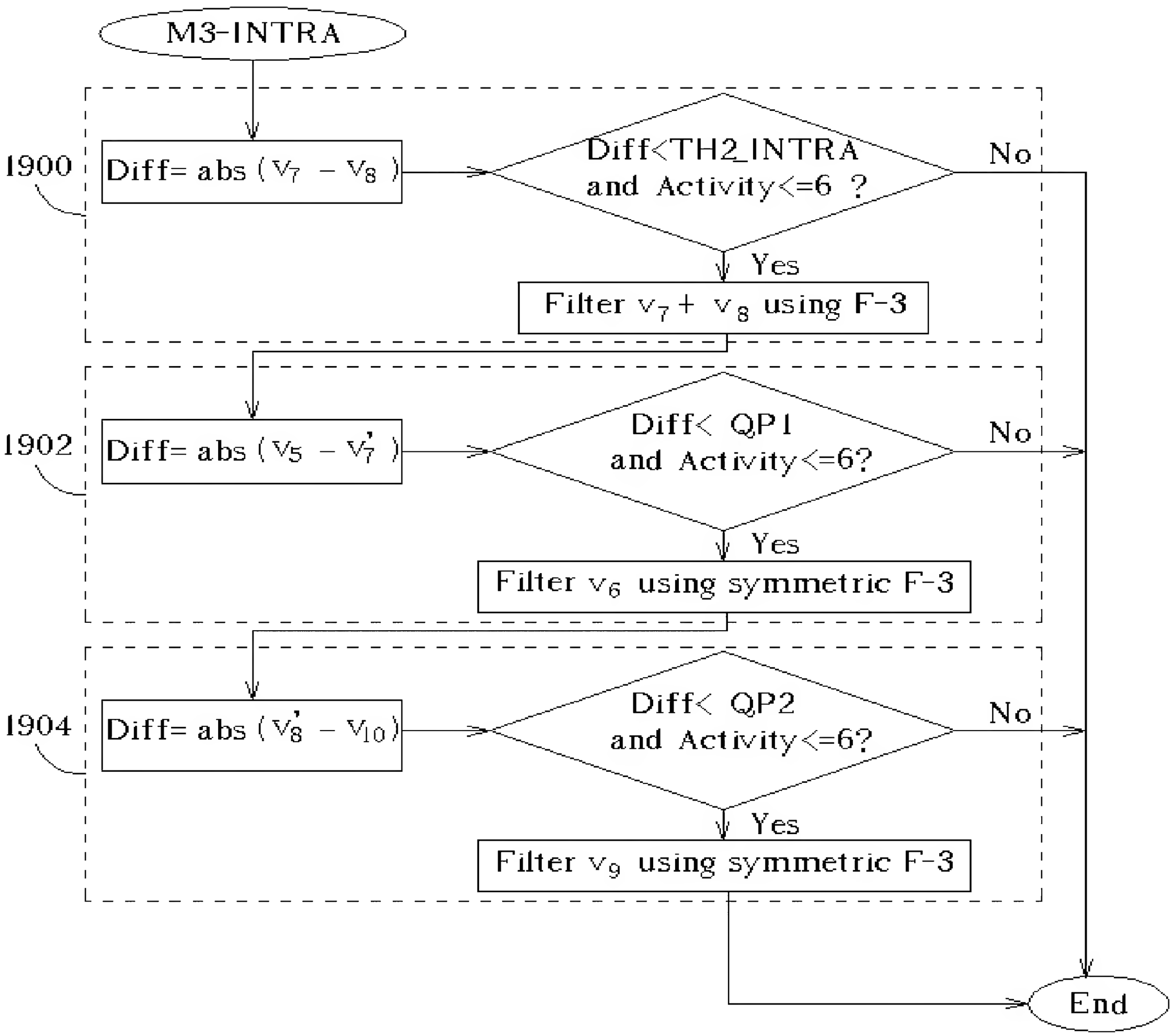

M3-INTRA
1900
Diff= abs (V7 - V8)
Diff<TH2_INTRA and Activity<=6 ?
No
Yes
Filter v7 + v8 using F-3
1902
Diff= abs (V5 - V7')
Diff< QP1 and Activity<=6?
No
Yes
Filter v6 using symmetric F-3
1904
Diff= abs (V8' - V10)
Diff< QP2 and Activity<=6?
No
Yes
Filter v9 using symmetric F-3
End

Fig. 19

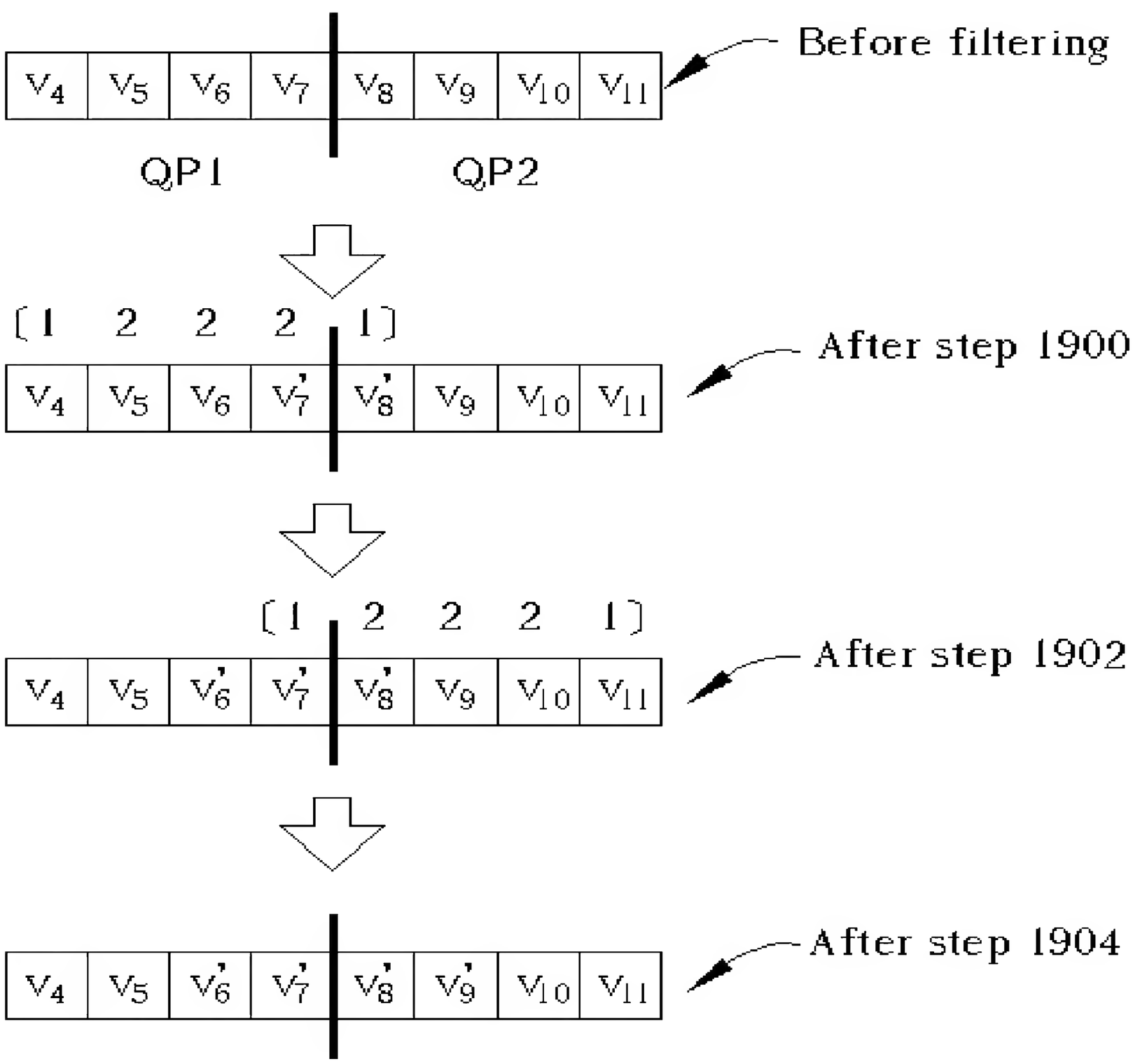
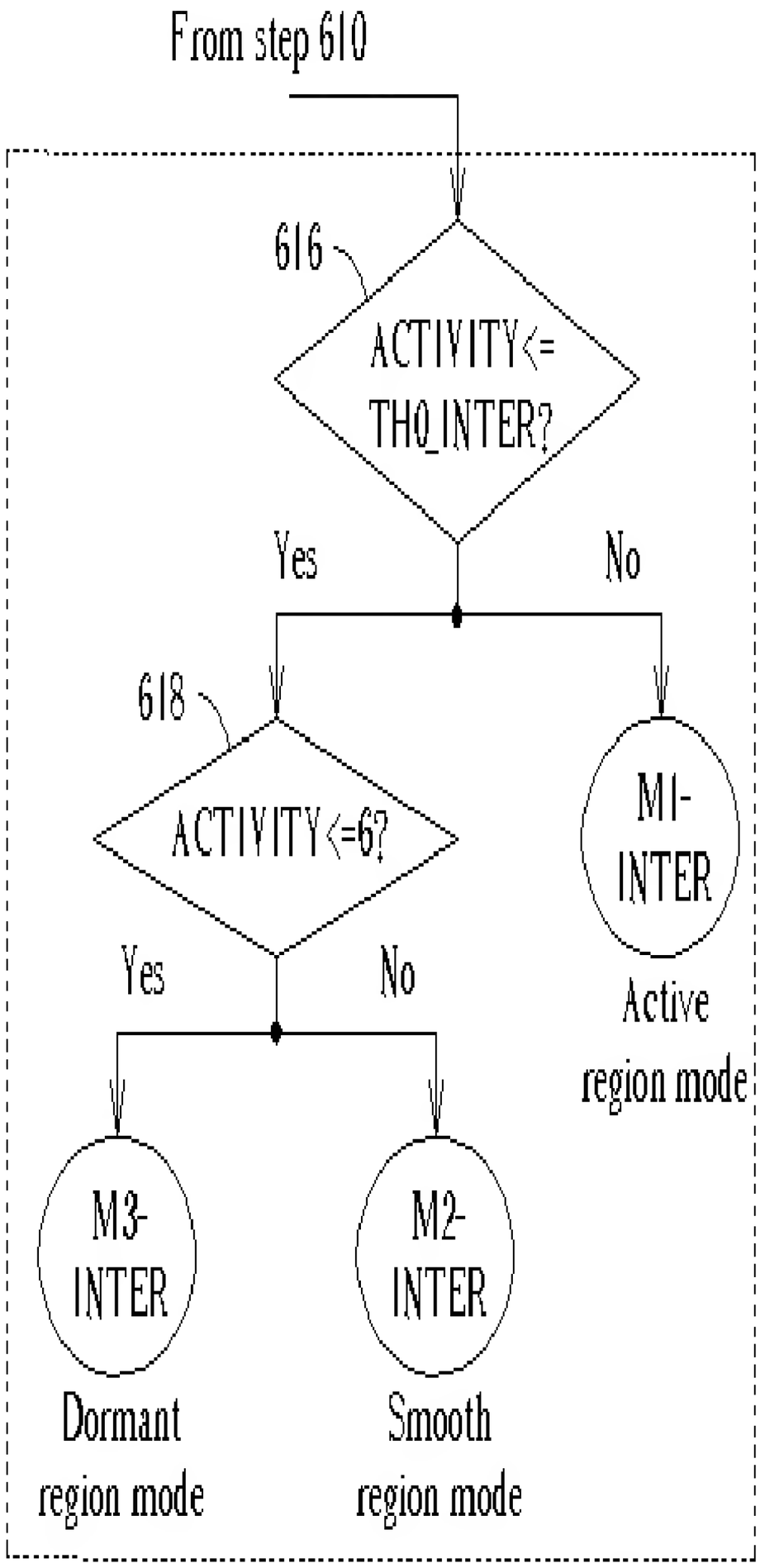

Before filtering
V4 V5 V6 V7 V8 V9 V10 V11
QP1
QP2
[1 2 2 2 1]
After step 1900
V4 V5 V6 V7' V8' V9 V10 V11
[1 2 2 2 1]
After step 1902
V4 V5 V6' V7' V8' V9 V10 V11
After step 1904
V4 V5 V6' V7' V8' V9' V10 V11

Fig. 20



Category 2

Fig. 21

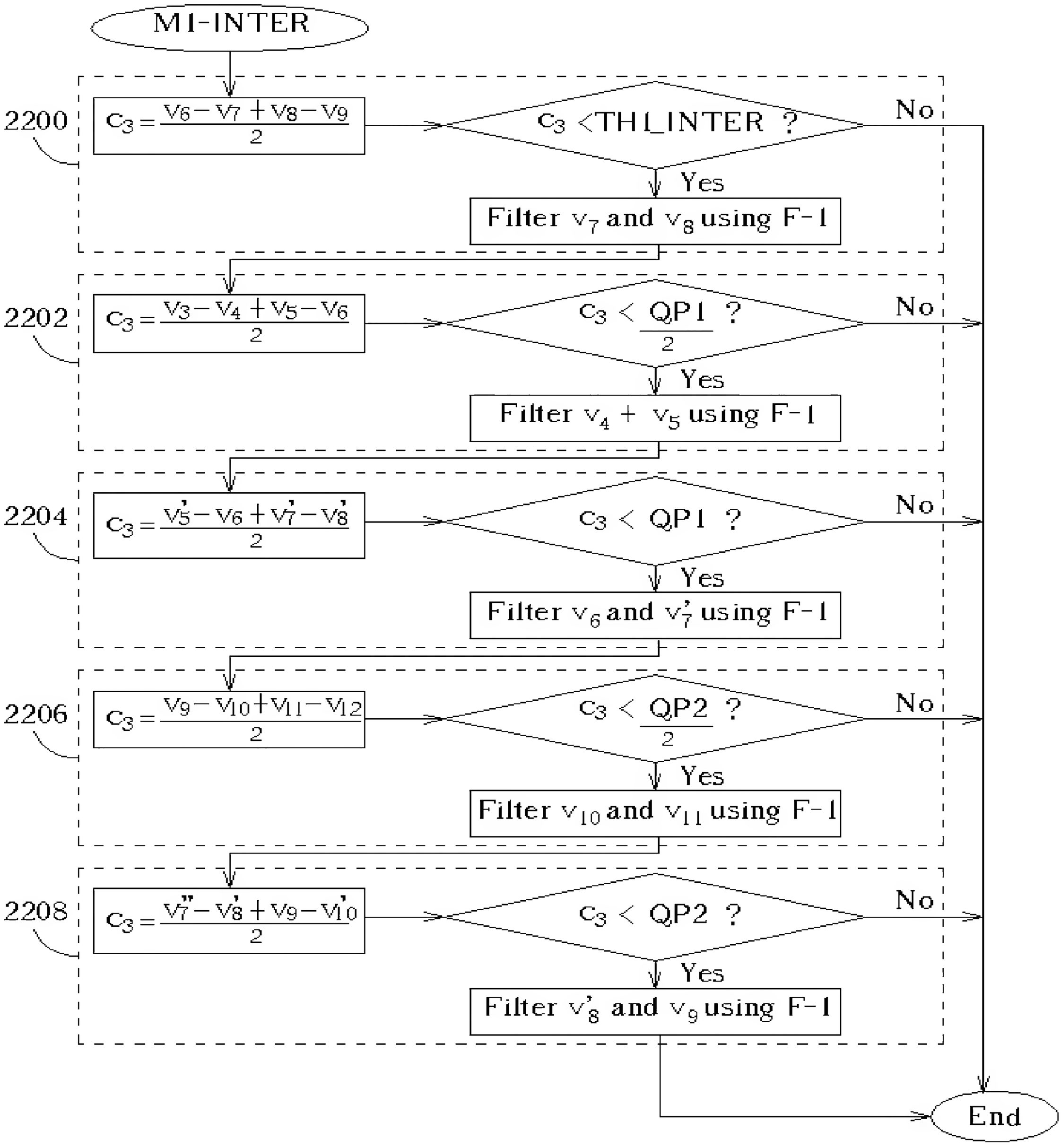

MI-INTER
2200
$C_3 = \frac{V_6 - V_7 + V_8 - V_9}{2}$
C_3 <THI_INTER ?
No
Yes
Filter v_7 and v_8 using F-1
2202
$C_3 = \frac{V_3 - V_4 + V_5 - V_6}{2}$
$C_3 < \frac{QP1}{2}$?
No
Yes
Filter $v_4 + v_5$ using F-1
2204
$C_3 = \frac{V_5' - V_6 + V_7' - V_8'}{2}$
$C_3 < QP1$?
No
Yes
Filter v_6 and v_7' using F-1
2206
$C_3 = \frac{V_9 - V_{10} + V_{11} - V_{12}}{2}$
$C_3 < \frac{QP2}{2}$?
No
Yes
Filter v_{10} and v_{11} using F-1
2208
$C_3 = \frac{V_7'' - V_8' + V_9 - V_{10}'}{2}$
$C_3 < QP2$?
No
Yes
Filter v_8' and v_9 using F-1
End

Fig. 22

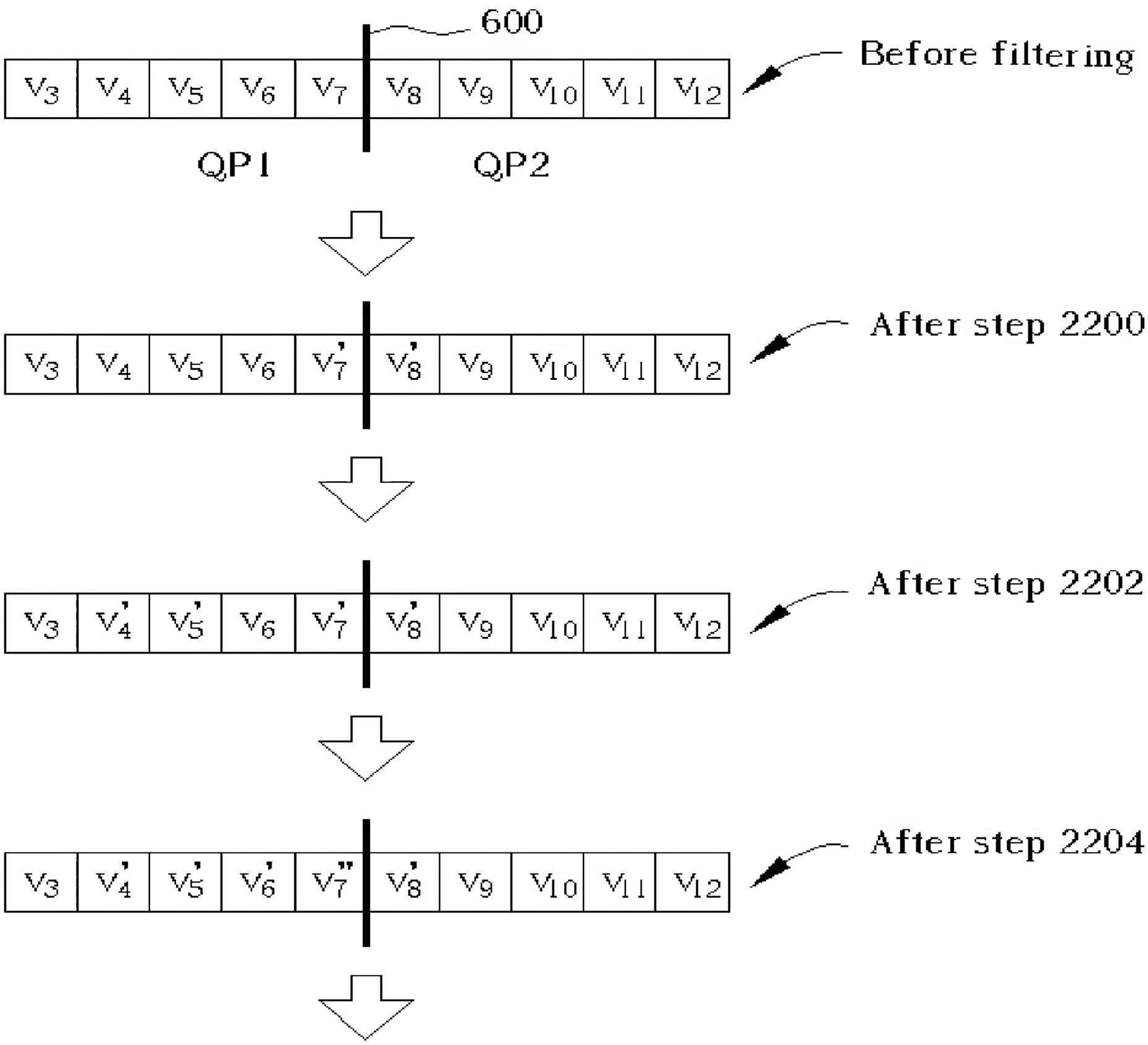

600
Before filtering
V3 V4 V5 V6 V7 V8 V9 V10 V11 V12
QP1
QP2
After step 2200
V3 V4 V5 V6 V7' V8' V9 V10 V11 V12
After step 2202
V3 V4' V5' V6 V7' V8' V9 V10 V11 V12
After step 2204
V3 V4' V5' V6' V7" V8' V9 V10 V11 V12
After step 2206
V3 V4' V5' V6' V7" V8' V9 V10' V11' V12
After step 2208
V3 V4' V5' V6' V7" V8" V9' V10' V11' V12

Fig. 23

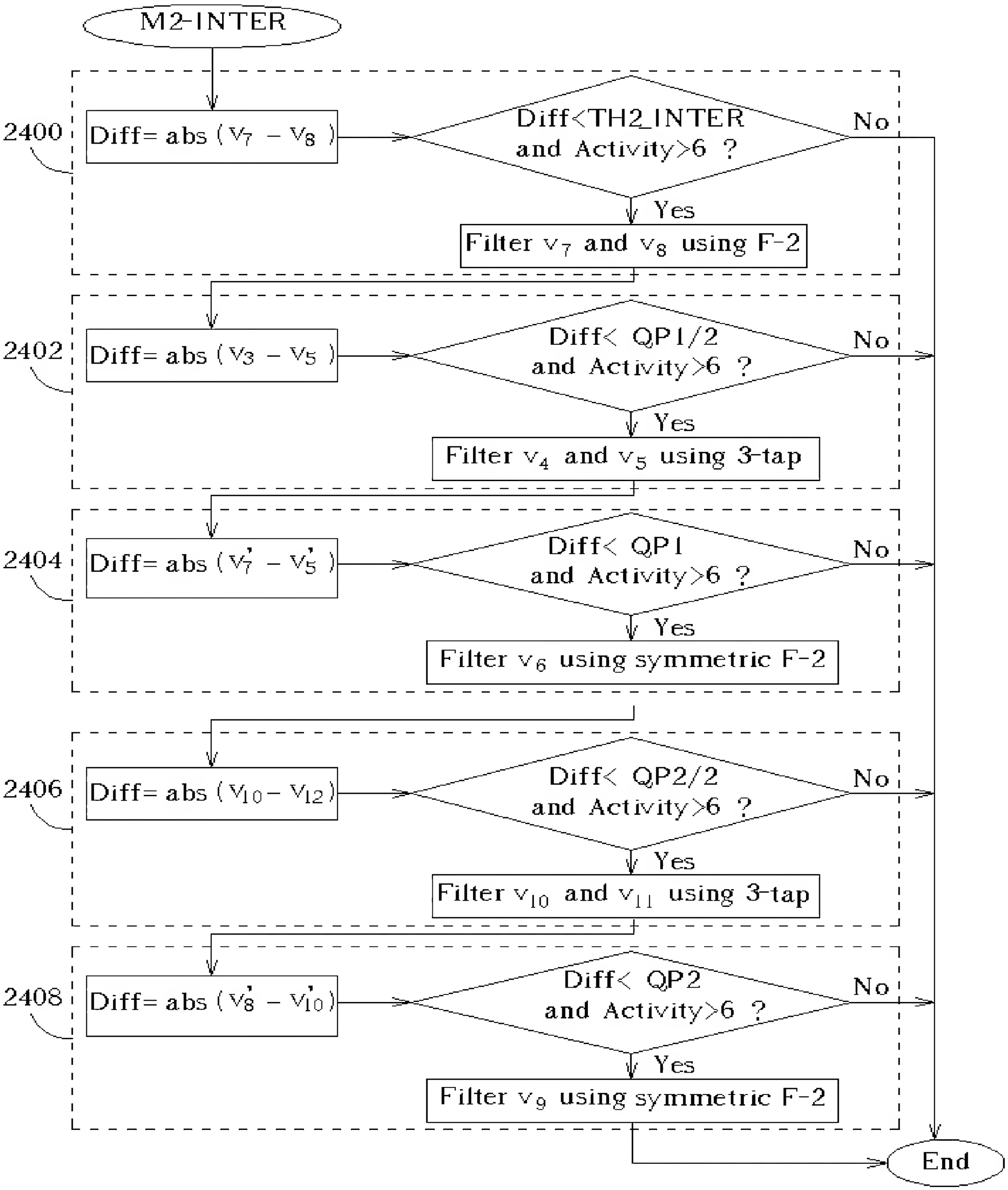

M2-INTER
2400
Diff= abs (V7 – V8)
Diff<TH2_INTER and Activity>6 ?
No
Yes
Filter V7 and V8 using F-2
2402
Diff= abs (V3 – V5)
Diff< QP1/2 and Activity>6 ?
No
Yes
Filter V4 and V5 using 3-tap
2404
Diff= abs (V'7 – V'5)
Diff< QP1 and Activity>6 ?
No
Yes
Filter V6 using symmetric F-2
2406
Diff= abs (V10 – V12)
Diff< QP2/2 and Activity>6 ?
No
Yes
Filter V10 and V11 using 3-tap
2408
Diff= abs (V'8 – V'10)
Diff< QP2 and Activity>6 ?
No
Yes
Filter V9 using symmetric F-2
End

Fig. 24

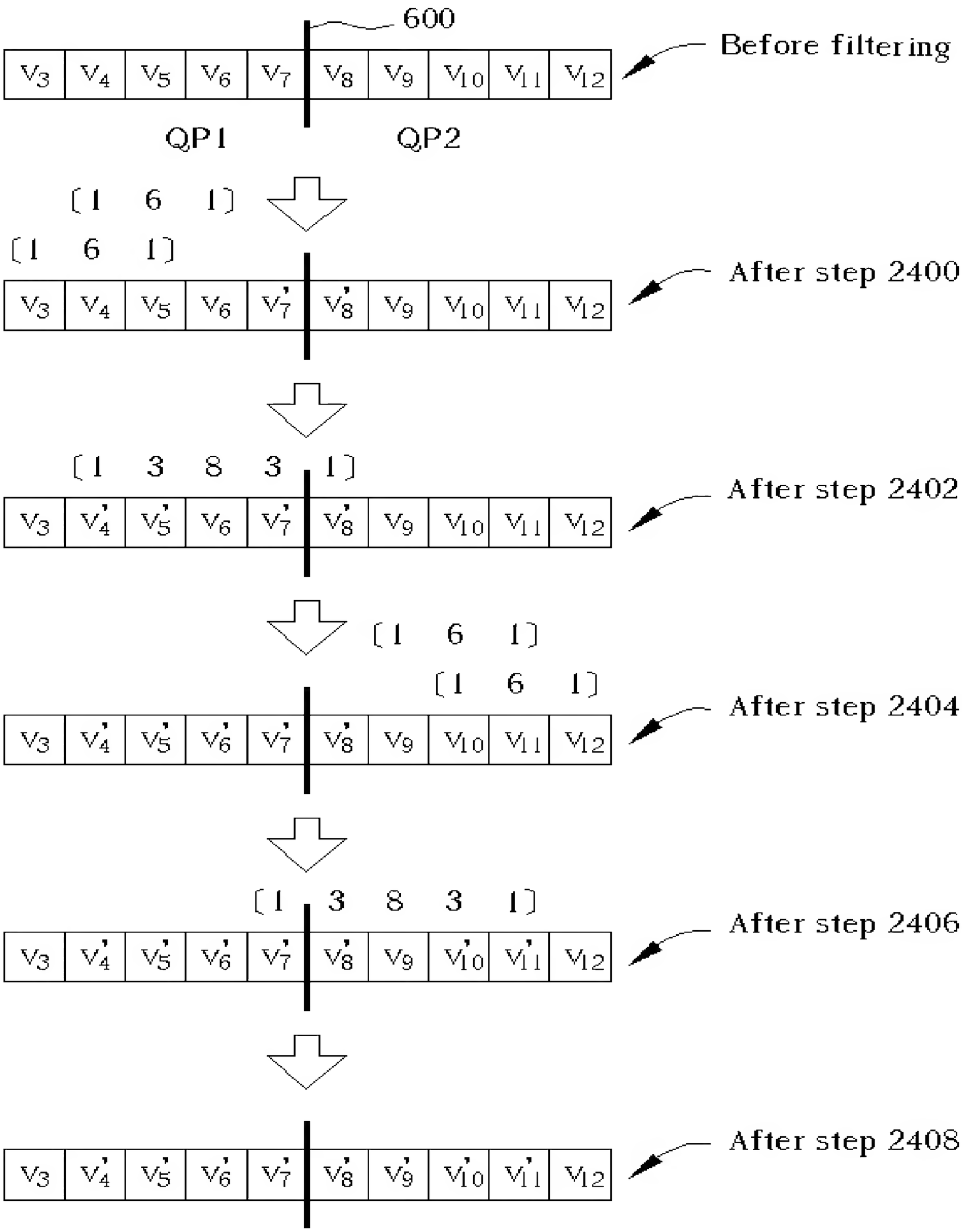

600
Before filtering
V3 V4 V5 V6 V7 V8 V9 V10 V11 V12
QP1
QP2
[1 6 1]
[1 6 1]
After step 2400
V3 V4 V5 V6 V7' V8' V9 V10 V11 V12
[1 3 8 3 1]
After step 2402
V3 V4' V5' V6 V7' V8' V9 V10 V11 V12
[1 6 1]
[1 6 1]
After step 2404
V3 V4' V5' V6' V7' V8' V9 V10 V11 V12
[1 3 8 3 1]
After step 2406
V3 V4' V5' V6' V7' V8' V9 V10' V11' V12
After step 2408
V3 V4' V5' V6' V7' V8' V9' V10' V11' V12

Fig. 25

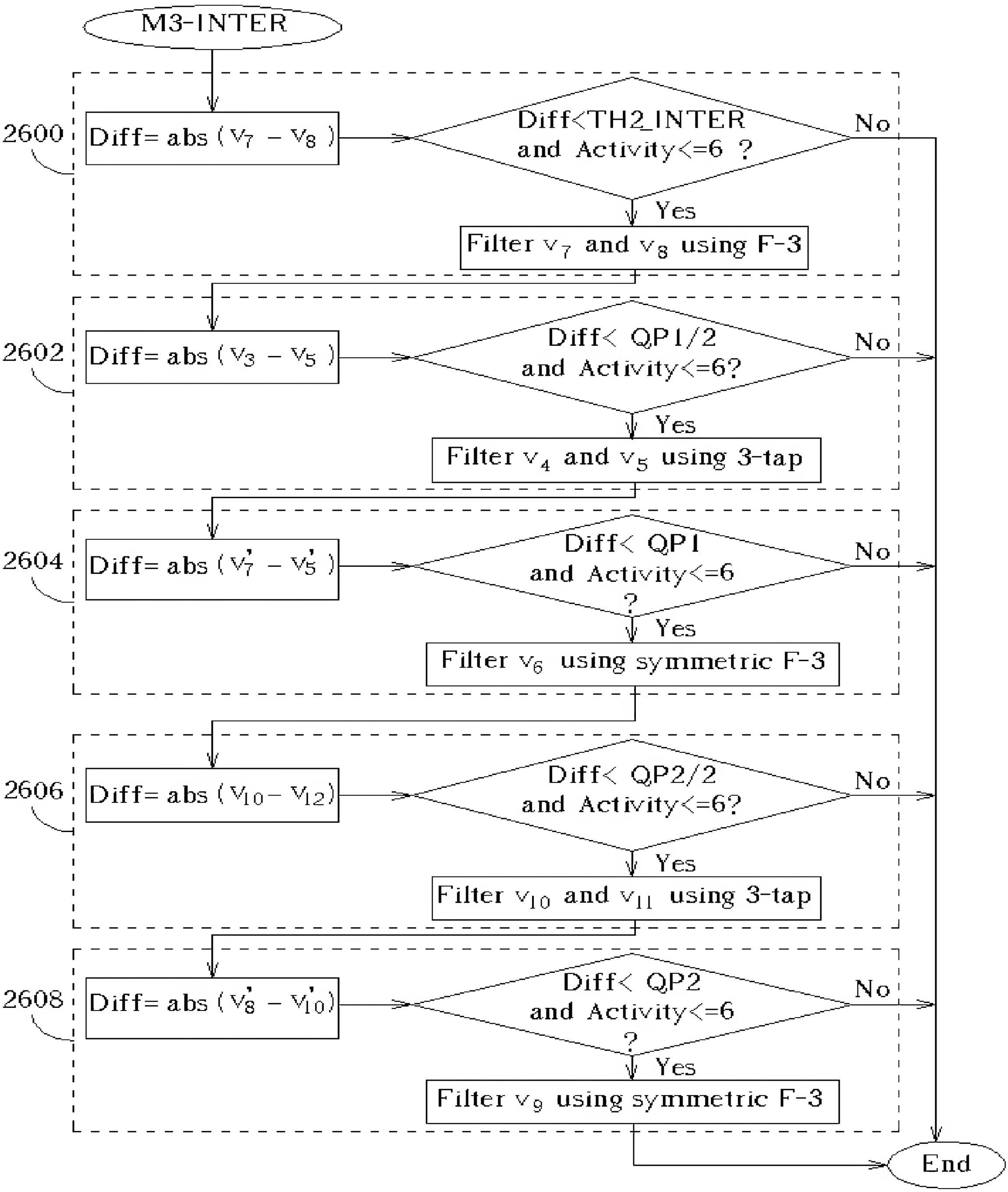

M3-INTER
2600
Diff= abs (v_7 – v_8)
Diff<TH2_INTER and Activity<=6 ?
No
Yes
Filter v_7 and v_8 using F-3
2602
Diff= abs (v_3 – v_5)
Diff< QP1/2 and Activity<=6?
No
Yes
Filter v_4 and v_5 using 3-tap
2604
Diff= abs (v'_7 – v'_5)
Diff< QP1 and Activity<=6 ?
No
Yes
Filter v_6 using symmetric F-3
2606
Diff= abs (v_{10} – v_{12})
Diff< QP2/2 and Activity<=6?
No
Yes
Filter v_{10} and v_{11} using 3-tap
2608
Diff= abs (v'_8 – v'_{10})
Diff< QP2 and Activity<=6 ?
No
Yes
Filter v_9 using symmetric F-3
End

Fig. 26

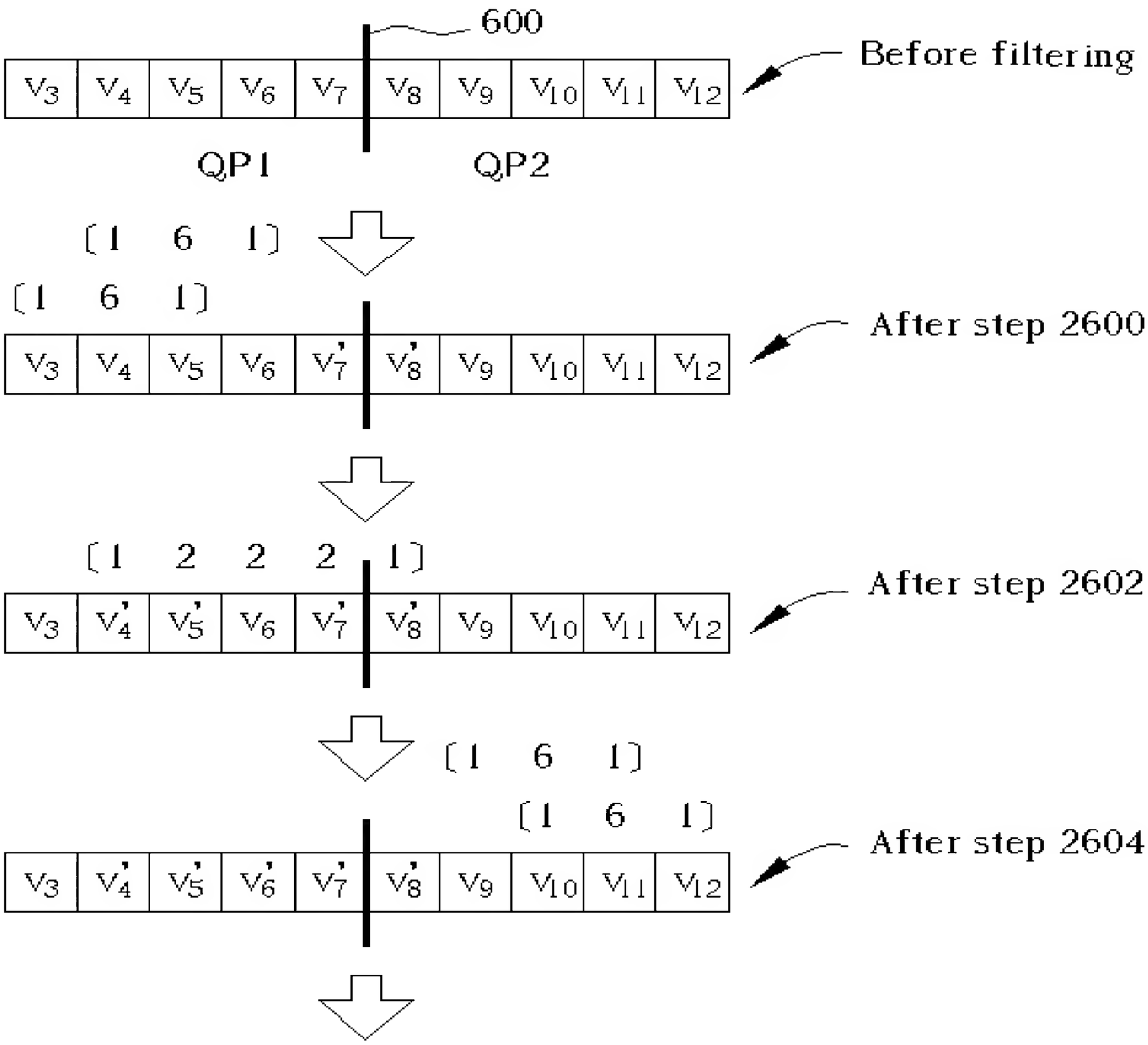

600
Before filtering
V3 V4 V5 V6 V7 V8 V9 V10 V11 V12
QP1
QP2
[1 6 1]
[1 6 1]
After step 2600
V3 V4 V5 V6 V7' V8' V9 V10 V11 V12
[1 2 2 2 1]
After step 2602
V3 V4' V5' V6 V7' V8' V9 V10 V11 V12
[1 6 1]
[1 6 1]
After step 2604
V3 V4' V5' V6' V7' V8' V9 V10 V11 V12
[1 2 2 2 1]
After step 2606
V3 V4' V5' V6' V7' V8' V9 V10' V11' V12
After step 2608
V3 V4' V5' V6' V7' V8' V9' V10' V11' V12

Fig. 27

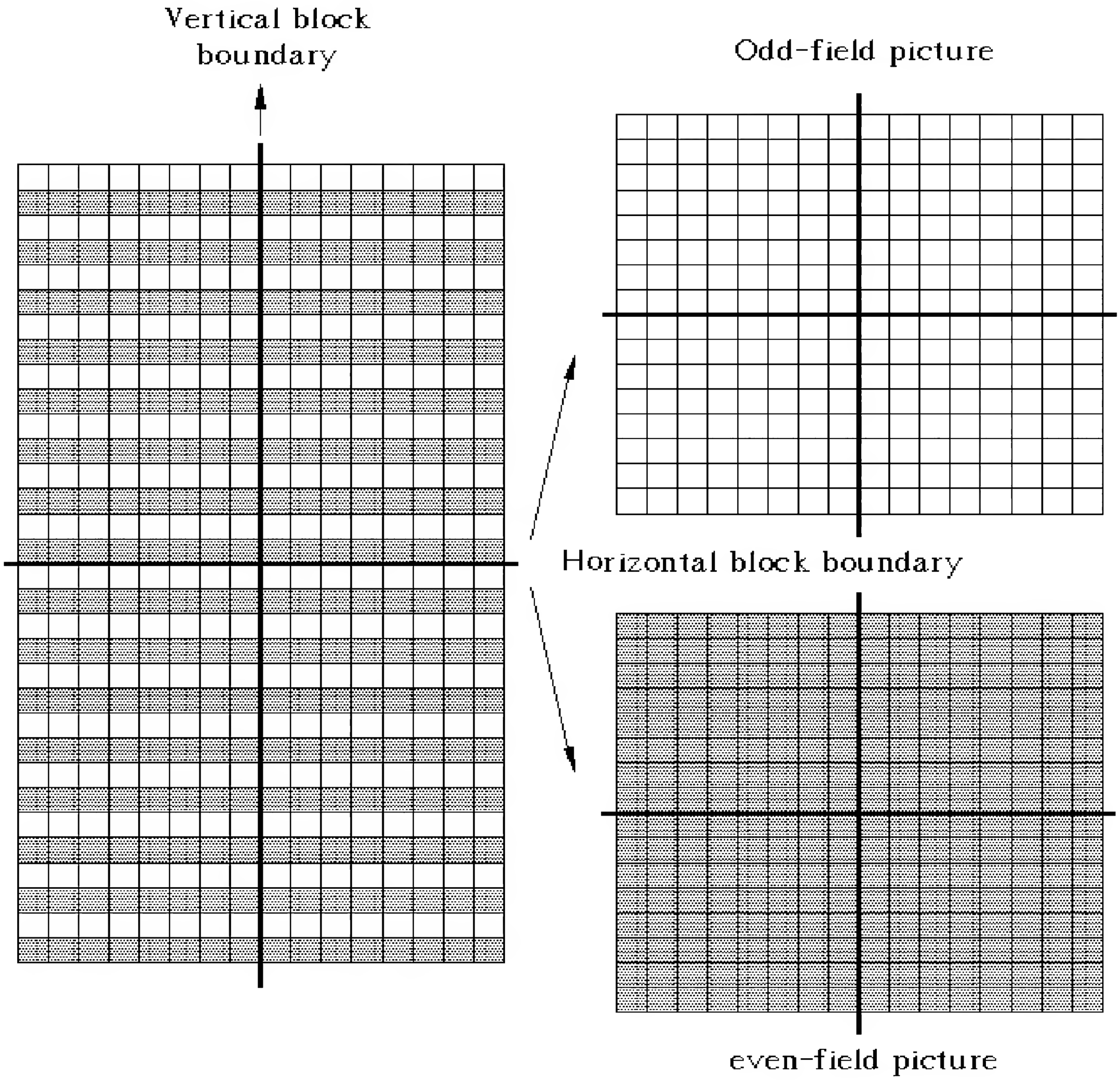
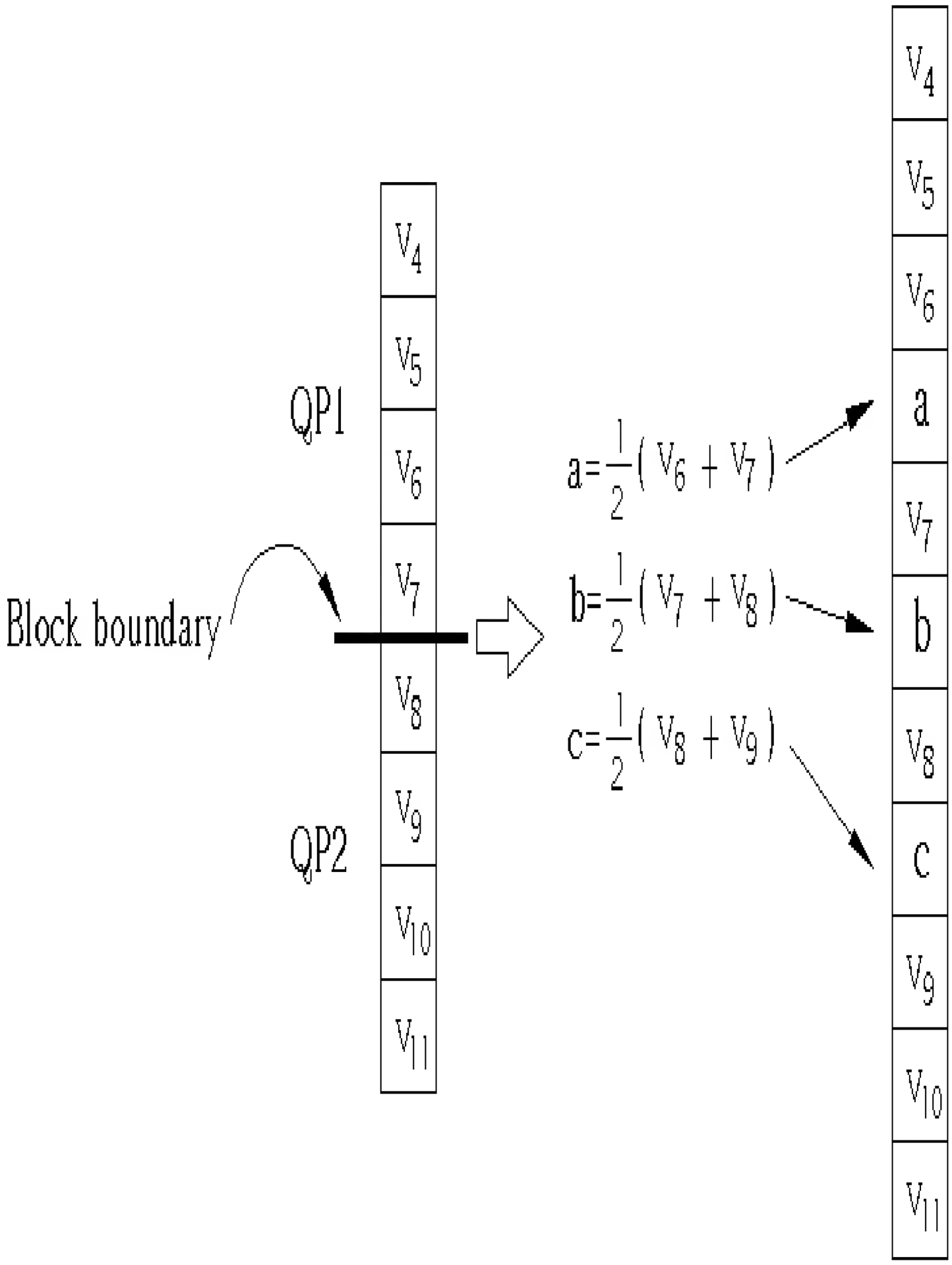

Vertical block boundary
Odd-field picture
Horizontal block boundary
even-field picture

Fig. 28



Original pixels in field-coded picture

Fig. 29